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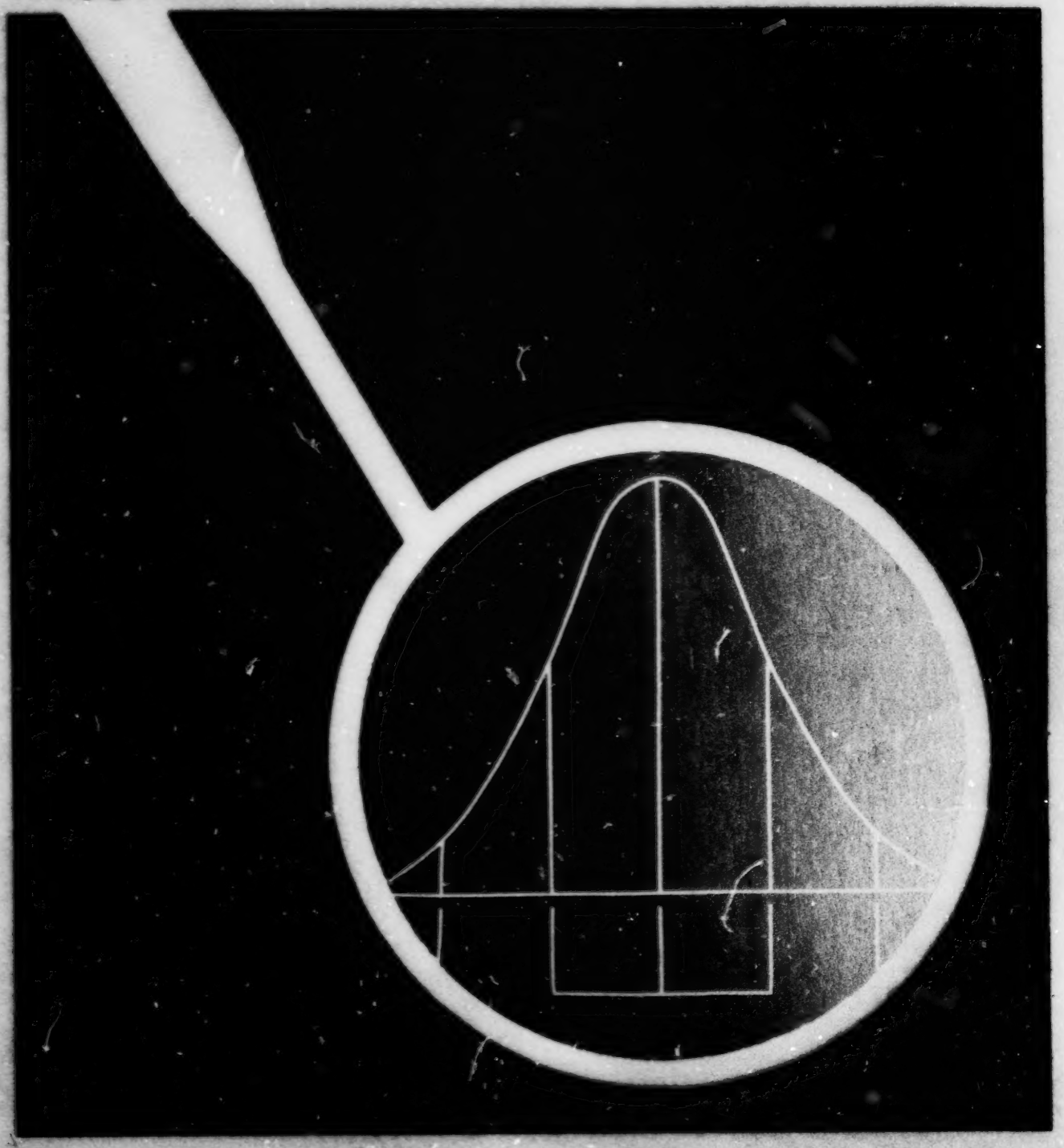
PROCEEDINGS OF THE

Conference on Dental Hygiene Research

Winnipeg, Manitoba



The School of Dental Hygiene, University of Manitoba and the Working Group on the Practice of Dental Hygiene, Department of National Health and Welfare, Canada.

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INTRODUCTION

In 1981 the federal government of Canada established a Working Group on the Practice of Dental Hygiene. Through its Subcommittee on Research, the Working Group collaborated with the University of Manitoba School of Dental Hygiene to implement the first Conference on Dental Hygiene Research, held in Winnipeg, Manitoba, on September 30 and October 1, 1982.

Dental hygiene in Canada may be described as a developing health profession. According to the Canada Health Manpower Inventory, the number of hygienists in Canada increased from 746 to 3924 in the years between 1970 and 1980. Twenty-four dental hygiene education programs now exist, almost all at the diploma (non-degree) level. Despite this, many hygienists have pursued education beyond the diploma level.

In recent years, dental hygienists have begun to participate in research, applying their interest and knowledge in dental hygiene with other areas such as nutrition, epidemiology, education, behavioral psychology, periodontology, and dental materials. While this development is encouraging, research participation has tended to be episodic and isolated from similar work being done by other dental hygienists. The Conference on Dental Hygiene Research was intended to eliminate isolation and increase hygienists' awareness of many research questions of potential interest to dental hygiene investigators.

The overall goal of the conference was to encourage participation of Canadian dental hygienists in research. Specifically, by the end of the two-day conference, each participant would:

1. have identified and discussed several research areas of interest;
2. have defined two specific research questions in at least one of these areas, in consulation with one or more conference leaders;
3. be able to identify appropriate funding sources;
4. have the names of potential research collaborators.

Fourteen distinguished researchers and consultants from across Canada and the United States served as conference leaders. Forty-two hygienists, from educational, public health, hospital, and private practice settings, registered as participants. The conference format was designed to facilitate small group discussion and individual consultation with leaders as well as to provide presentation of papers to the entire group.

By any measure, the conference was judged to be a great success. In particular, the interest it has created in increased participation in research by Canadian dental hygienists, and the establishment of networks among hygienists and leaders with similar research interests may prove to be outstanding contributions to the development of dental hygiene in Canada.

Margery Forgay, RDH, MA
Chairman,
Conference Organization Committee

CONFERENCE PROGRAM

Thursday
September 30

8:15–8:45 a.m. Registration

8:45 **CONFERENCE WELCOME** — Sheryl Feller
GREETINGS:
Canadian Dental Hygienists' Association — Mary Pelletier
Canadian Fund for Dental Education — Walker Shortill
National Health Research and Development Program — Ron Heacock
Working Group on the Practice of Dental Hygiene — Diane Harvey
University of Manitoba — Arthur Schwartz

9:00 **RESEARCH AND THE DENTAL HYGIENIST — A LIFELINE TO PROFESSIONALISM** — John W. Stamm

9:45–10:00 Questions and Discussion

10:00 Coffee

10:30 **TOWARD A CLEARER UNDERSTANDING OF DENTAL HYGIENE RESEARCH, THEORY, AND PRACTICE** — Michele Leonardi Darby

10:50 Questions and Discussion

11.00 **DENTAL HYGIENE RESEARCH DEVELOPMENT OF ADHA: 1977-1982** — Denise O'Brien

11:45 Questions and Discussion

12:00 Lunch

1:30–4:15 p.m. **PANEL PRESENTATIONS AND WORKSHOP GROUPS**

1:30 **RESEARCH IN EDUCATION** — Jean-Paul Lussier, Chair
Panelists: Denise M. Bowen, Don W. Lewis, Denise O'Brien
Questions and Discussion
RESEARCH IN PREVENTION — Pat Johnson, Chair
Panelists: Joanne Clovis (for Alice M. Horowitz), John W. Stamm
Questions and Discussion

2:45 **SUB-GROUPS: TOPIC GENERATION**

3:00 Coffee

3:30 **SUB-GROUPS: DEFINITION OF RESEARCH QUESTIONS: IDENTIFICATION OF RESOURCES**

4:15 **PROGRESS REPORTS** — Sheryl J. Feller

7:30 Conference Dinner

Friday
October 1

8:45 a.m. **RESEARCH FUNDING**
— Sheryl J. Feller, Chair
Colin Dawes; Ron A. Heacock

9:45 Questions and Discussion

10:00 Coffee

10:30–2:45 **PANEL PRESENTATIONS AND WORKSHOP GROUPS**

10:30 **HEALTH PROMOTION, BEHAVIORAL SCIENCES, AND IMPLICATIONS OF AN AGING POPULATION** — Ellen Brownstone, Chair
Panelists: Dexter A. Harvey; Lois K. Cohen; Sheryl J. Feller
Questions and Discussion
MANPOWER, ECONOMICS AND DENTAL CARE DELIVERY — Joanne Clovis, Chair
Panelists: Don W. Lewis; John M. Horne; David G. Fish
Questions and Discussion

11:45 **SUB-GROUPS: TOPIC GENERATION**

12:00 Lunch

1:00 p.m. **SUB-GROUPS: DEFINITION OF RESEARCH QUESTIONS; IDENTIFICATION OF RESOURCES**

2:15 Consultations with Conference Leaders — Gateway Room
Coffee

2:45 **PROGRESS REPORTS** — Sheryl J. Feller, Gateway Room

3:15 **CONFERENCE SUMMARY** — Jean-Paul Lussier

RESEARCH AND THE DENTAL HYGIENISTS: A LIFELINE TO PROFESSIONALISM

John W. Stamm

Introduction

It is a distinct honour not only to have been invited to this first Canadian Conference on Dental Hygiene Research but also to have the opportunity to address a distinguished group of dental hygienists on one of the several subjects critical to the future of dental hygiene. The subject of research is one that interests me not only because of its intrinsic value to society, or its central role in university life, or the fascinating historical literature that surrounds it, but also because true research is a gripping, satisfying endeavour to the individual or group conducting it. In addition, it is fair to say that research tends to be accompanied by the development of a network of colleagues, both near and far, that greatly enhances the quality of work for those lucky enough to be part of the réseau.

As I see it, the task assigned to me today is a specific one, namely to provide an overview or framework of how research might be advanced in dental hygiene. For this reason I have chosen to title my presentation Research and the Dental Hygienist: A Lifeline to Professionalism. The title implies certain key themes I would like to highlight. First and foremost, I believe that the emerging interest in research at the level of organized dental hygiene is activated in part by a desire for the pursuit of knowledge but in much larger part by the strong aspiration for professionalism. Hence I would like to analyze what makes a profession and the role research is being asked to play in pursuit of achieving the status of a profession. Second, I deliberately worded the first half of my title as research and the dental hygienist rather than, for example, research in dental hygiene. This was done to afford me the opportunity to analyze with you whether dental hygiene is a discipline with inherent theory to be elaborated by research or whether dental hygiene is an area of health care, a field for study, that can and should be investigated using a variety of existing discipline-based methodologies. A careful consideration of this question is crucial since it will dictate whether dental hygienists, in their graduate and research training, follow the path to professionalism chosen by nurses or adopt the strategy chosen by, for example, physical and occupational therapists.

A third theme of this presentation, and one not implicit in the title, is to outline some concrete steps that Canadian dental hygiene might take to better realize its dual objective of research and professionalism. Although related to the previous point, I believe it is essential to examine certain characteristics about dental hygiene in Canada and to show how these ought to dictate, in part, where the emphasis should be placed to enable hygienists to become successful researchers.

What is a Profession?

Turning to my first theme, research and professionalization, I would like to begin by offering a brief but systematic treatment of the term profession. Depending on whom one believes, dental hygiene is already a profession[1,2] is struggling to become a profession,[3] or has no chance of being a profession in the foreseeable future. The first belief is generally held by dental hygiene leaders, the second by rank and file dental hygienists and the third may be imputed to relatively detached scholars, particularly sociologists, who have made the study of professions their career.[4] What is a profession?

To make some sense out of these contradictions, it is useful to recognize two broad, sometimes overlapping groups of professions. The first comprises the learned or scholarly professions resident in universities and a variety of research institutes. In their day-to-day work, these professionals interact mainly with fellow workers; their work is not client based. The second category of professionals may be labelled as the consulting or service professions. This group depends critically on the day-to-day contact with outside clients or patients. Clearly, it is this latter domain that interests dental hygiene the most and it is the one I intend to discuss from this point.

With this clarification, it may further illuminate things to recognize that a profession is commonly understood as being a special kind of occupation, and further, that it entails an avowal or promise of ethical practice. But these two characteristics are so general that they do not help in properly defining the term profession. In a methodological sense, they do not serve as effective exclusion criteria. Possible definitions are further complicated by the fact that beyond use as a purely descriptive term, the title profession is also used in an evaluative manner. This is to say, all sorts of occupational groups apply the term profession to themselves because it evokes certain qualities which, it is hoped, will persuade others of the group's importance. So various are the occupations that have labelled themselves professions that no common characteristic can be discerned — except the yearning for prestige.[5] A final difficulty in arriving at a satisfactory definition of profession relates to the approach whereby one draws up a list of occupations that are presumed to be professions and then determines which characteristics they have in common. As opposed to the so-called functionalist methodology, this trait approach is logically wrong and also fails in application since different people generate different lists of professions with the result that no definition can be achieved or the definition is so general as to be worthless.[6] One analytically serviceable definition has been provided by Freidson who defines a profession as "an occupation which has assumed a dominant position in a division of labour so that it gains control over the determination of the substance of its own work."[7] Freidson adds that a profession is autonomous or self-directing. A profession retains this special status by its persuasive profusion of the extraordinary trustworthiness of its members. The profession claims that this trustworthiness is based upon ethicality, knowledge and skill. In fact, any profession claims to be the most reliable authority on the nature of the reality it deals with.[7]

For an occupation to be secure as a profession requires at least three conditions. First, the occupation needs the exclusive control of and access to the key or strategic practice technologies without which no one else could function in that occupation. Second, professional security requires that the occupational group be the sole or prime source for criteria that allow qualification and entry of new individuals to practise in the field. Third, to become and remain a profession it is crucial that the public believe in the occupation's competence, in the value of its knowledge and skill. In the long run, the last condition is probably the most important of the three.

Research — A Building Block for a Profession

To this point I have tried to present an overly brief but coherent notion of what is represented by the concept of profession. Next I would like to briefly outline some key steps that are traditionally taken by virtually all occupations seeking to assume professional status. It is apparent that research represents one of these steps, although it is usually not the first one taken along the way. Since the pattern differs between Europe and North America, I will only examine the sequence as it occurs in Canada and the United States. One of the more helpful analyses has been provided by Wilensky[8] who has studied the activities pattern of occupations seeking professional status. The steps which can almost always be detected in the historical development of a profession are as follows:

1. Full-time activity at the task.
2. Establishment of university training.
3. National professional association.
4. Redefinition of the core task, so as to give the "dirty work" over to subordinates.

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5. Conflict between the old timers and those who seek to upgrade the job.
6. Competition between the new occupation and neighboring ones.
7. Political agitation in order to gain legal protection.
8. Code of ethics.

While it is clear that not all the steps apply to every aspiring profession and that the sequence will also differ for various groups, there is enough commonality to give the scheme considerable credibility. One particular relevant modification to consider is that at any time an occupation may be active simultaneously in a number of areas identified in the list.

For our purposes today, Wilensky's omission of research is rather noteworthy. Further, although he identifies the establishment of university training, I would still suggest that this understates the drive by aspiring professions to persuade others of the existence of a unique and codified body of knowledge relevant to that occupation. The most germane example of an occupation pressing hard on both the matter of specialized knowledge and research is nursing. Nursing's growing emphasis on baccalaureate training[9] as well as the increasing flow of textbooks emphasizing nursing theory[10] and research[11,12] attest to this development. The journal *Nursing Research* has been published since 1952. A good account of the importance nurses attach to research in the pursuit of professional development can be found in the first chapter of the text by Polit and Hungler.[11]

To state it precisely, a relative handful of dental hygienists, let us call them dental hygiene leaders, have also recognized the need to enhance research among hygienists. This can be documented more readily in the USA than in Canada. For example, during the late 1970s through to 1980, the journal *Dental Hygiene* published a regular one or two-page feature entitled "Research." Just as an aside, this regular item has been dropped from the more recent issues of *Dental Hygiene* and in its place the Journal appears to be placing much greater emphasis on the concept of professionalism for dental hygienists, though the understanding and treatment of this topic does not seem to be particularly refined. Among American dental hygienists, one finds articulate and energetic advocates of research.[13,14] In Canada, dental hygienists have placed proportionately less emphasis on dental research. A review of all the volumes of *The Canadian Dental Hygienist* indicates little evidence of empirically based investigations. As I will show later, there may be a good reason for this.

In spite of this rather pessimistic assessment of the aggregate dental hygiene research effort, I remind you that there are dental hygienists who are well regarded researchers. Their names are familiar to most of you. If we look for some common characteristics in these dental hygiene researchers, I believe it can be said that they possess two traits. One, they are highly intelligent, energetic and well motivated people who would have succeeded in any one of a number of careers. Two, virtually all of them are applying superior graduate research training in the pursuit of significant dental health problems. This point will tie in to a hypothesis I would like to advance later.

At this juncture we should stop and ask just how important is research to the process of professionalization. After all, in the definition of research cited earlier only dominance and autonomy seemed to matter. The answer is that professional status cannot be forced, it can only be attracted. More precisely, professional status will only be conferred by a society that is persuaded that the aspiring profession possesses an ideal of service together with a coherent body of knowledge and technology beyond that possessed by average members in that society.[4,7] Clearly, research is a necessary enterprise to establish and enlarge the knowledge base and to develop the technology with which the occupation hopes to make its case as a profession to the larger society.

Evidence for this perspective is present in the historical development of the medical and dental professions as well as in the activities of nursing during the past 20 years. We should recall that the prestige and power of the medical profession grew dramatically during the period of 1900 to 1920. It was during this time that medicine began to incorporate the great discoveries made in the middle to late 1800s in the fields of bacteriology, physiology and chemistry so that by 1900, it is often said, the patient began to have a better than 50/50 chance of benefitting from an encounter with a physician. This impact of research on medical practice was multiplied by the recommendations contained in the famous Flexner report[15] of 1910 which served as the basis for the reform and upgrading of educational standards in medicine during the decade 1910-1920. It was this confluence of research and education that gave medicine its great technical successes and persuaded society, through its governing bodies, that medicine deserved the legislation it sought to secure the power of the profession. Dentistry's history parallels medicine in that research led to significant technical advances in the fields of direct restorative materials, local anesthesia, radiology, etc., which, as a result of the reforms recommended in the Gies report[16] of 1926, were increasingly and methodically incorporated into a university-based system of dental education. The result was the rapid elevation of dentistry to the group of top-ranked professions. It is apparent that nursing, which has had a long history of controlling its own licensure,[17] has been persuaded that it too must place more emphasis on research and educational standards if its hopes of professional status are to be fully realized. A code of ethics and pledges of dedication and service are not enough.

Dental Hygiene: Area for Study or Discipline?

At this point I would like to move on to my second theme, namely, is dental hygiene a topic for study and research or is it a discipline with its own inherent theory? In so far as the answer to this question will determine the direction dental hygiene researchers will take in the future, I believe a careful analysis of the problem is vital not only to the successful growth of research but also to the very evolvement of dental hygiene as a profession. To see the issue somewhat more concretely, you might recall my earlier examples. On the one hand we have physical and occupational therapists whose graduate research training in a variety of disciplines such as physiology, kinesiology, ergonomics, epidemiology, etc., is being applied to solve the health problems that form the domain of physical and occupational therapy. In this conception, the practice of physical and occupational therapy forms an area for study and research. On the other hand we have nursing which claims that there exists a unique body of knowledge called nursing theory and that the future strength of nursing depends on the establishment of master and PhD level programs in nursing per se.[10] Thus nursing views itself as representing one *discipline* and is vigorously advocating research based on the paradigm of that discipline. Here I use paradigm in the Kuhnian sense.[18]

What does the distinction between an area of study and a discipline really imply? My response is based in an earlier analysis of this question by the York University economist Alan Williams.[19] In the context of oral health and disease, the area of study is characterized by the expanding set of tangible oral health problems whose solution depends, ultimately, on research carried out by specialized experts. Looked at in this way, the contributions to the knowledge of oral disease, its prevention or treatment can come from a wide range of specialized expertise. It is also true that such knowledge, and hence increasing expertise, develops by sustained investigations over decades or even centuries. As this specialized expertise accumulates it begins to flourish because of its success in dealing with the original as well as newer, closely related problems. At some point in this development, the dominant group working in the area of study begins to make repeated use of key concepts, acquires data in specific ways, examines structural relations in the data in a similar fashion and applies this knowledge to a common range of problems. When this has occurred a "mode of thinking" has evolved, to use Williams's phrase. This mode of thinking may also be termed as the discipline, and in the case of oral health, has and continues to be fostered by the profession of dentistry.

What is the relevance of all this for research by dental hygienists? Given the structure I have outlined above, the fundamental question arises as to whether or not the area of study descibed as dental hygiene is part of the discipline of dentistry or can be considered as an independent discipline with an inherently different set of theories. To put the matter squarely, dental hygienists must determine for themselves whether their future is better served by attempting, like the nurses, to establish a unique body of knowledge, a discipline, in which they will conduct most of their research or, alternatively, whether their future prospects are brighter by obtaining graduate research training in already established disciplines with the view to bringing in and apply-

ing this expertise to the domain of dental hygiene. There are no easy or completely satisfying answers to this question. Nor is it a question that can be solved for dental hygiene by guests, like myself, to your organization. But to at least stimulate some discussion, I would like to offer some of my personal views about why dental hygiene research would be best served by concentrating on rigorous graduate training in disciplines outside of dental hygiene.

First, while the nursing model may have some appeal, consider that in the U.S.A. alone there are more than 1 000 000 licensed nurses.[20] As such, nurses represent the largest single manpower category in the health care field. This has given nursing immense political clout through a large variety of channels. The situation is analogous in Canada where nurses outnumber physicians 5 to 1.[21] There are many implications to be drawn from this, which go beyond the scope of this presentation. But one thing is certain, when combined with the fact that nurses have for decades controlled their own licensing laws, the numerical advantage and the resultant muscle to determine research priorities goes far beyond what dental hygiene can realistically expect for itself in the foreseeable future. Therefore, dental hygienists should be careful about uncritical adherence to the nursing model.

Second, the establishment of dental hygiene on the single discipline model, à la nursing, raises a further problem. It must not be forgotten that the bulk of nursing work takes place in a variety of large, structured institutional settings. This gives both horizontal and vertical dimensions to nursing work, activities on which nurses can capitalize for graduate education and research purposes. For example, nurses are placing considerable emphasis on administrative theory and research into organization behavior. Clearly, nurses can draw on their large hospital role not only for the raw material for their research but also for its application. The analogous opportunities for the dental hygienist are far more constricted. In the main, I would think that dental hygiene education and certain public sector roles offer the best opportunities to the hygienist for unfettered development and application of research. However, this may not respond to the realities and aspirations of the majority of dental hygienists. The practice of nursing and dental hygiene are sufficiently different on several dimensions to suggest prudence in adapting the nursing orientation to research.

Third, it is a personal view that establishing a dental hygiene discipline-based research program increases the risk of falling into what I call advocacy research. By this I mean a type of research which has as its main objective the acceleration of professionalization and only secondarily the advancement of knowledge. This type of research often lapses into methodological weaknesses and tends not to be taken as seriously outside the confines of the occupation. As such, the knowledge generated by advocacy research will generally not be very effective in persuading society that professional status should be conferred. Remember that it is vital for the healing professions that they be consulted and the choice to consult cannot be forced — it must be attracted by the persuasive expertise and authoritativeness of the aspiring profession.

Fourth, it must of course be recognized that the model I am advocating, namely dental hygiene as an area of study and research, is not completely perfect either. One of the prime risks is that some dental hygienists who are encouraged to undertake rigorous graduate research training in a discipline outside dental hygiene may decide not to return to their original field of endeavour. Such individuals would then be lost, at least for a time, to dental hygiene. I make this point because I believe it is not a trivial one for dental hygiene. It represents a potential problem in the approach I am suggesting and is one that must be openly faced when discussing strategies for developing a research orientation for dental hygiene.

Strategic Steps for Encouraging Quality Research by Dental Hygienists

The third theme of my presentation deals very briefly with a consideration of the strategic steps for developing, in Canadian dental hygienists, a capacity for conducting quality research. When one discusses strategy it is well to realize that there is an alternative set of *tactical* activities which generally come after a general strategy has been laid down. I would ask you to think of strategic rather than tactical planning for research. I see four strategic issues that bear on the development of a research capacity for hygienists. In a rough sequential order they are: (1) the attainment of the first university degree; (2) the problem of institutional affiliation; (3) the matter of emphasizing personnel training ahead of research projects, and (4) the selection of an orientation for research by dental hygienists.

University Degrees in Dental Hygiene. Perhaps one of the harshest realities that dental hygiene leaders must squarely face is that rank and file dental hygienists do not have the formal academic background to undertake research that is credible in the 1980s. In my view, this is an issue that cannot be circumvented easily and moreover, appears to be a much greater problem in Canada than in the United States. The situation can be well demonstrated by looking at two recent studies of dental hygiene, one in each of the two countries.

Let us first look at the U.S. data. The 1979 study reported by Malvitz and Mocniak is based on a sample survey of dental hygienists conducted by the Chicago-based National Opinion Research Center (NORC) with initial analyses conducted by Policy Analysis, Inc. of Ann Arbor, Michigan.[22] Figure 1 is taken from that study and shows a frequency breakdown of the highest degree held by licensed hygienists. In many ways the chart shows the obvious, namely, that roughly three-quarters of American dental hygienists do not hold a baccalaureate degree. Compare this to the situation in Architecture, Dentistry, Divinity, Engineering or Medicine. An academic structure to promote good scholarly research is difficult to attain in most professional fields, and without overstatement I believe the breakdown in Figure 1 implies that it promises to be even more problematical in dental hygiene.

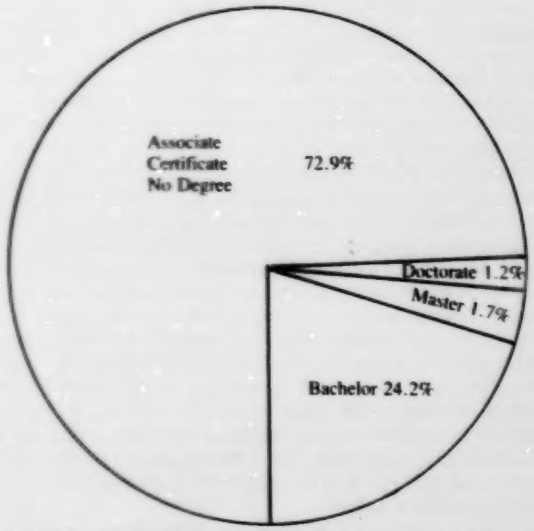

FIGURE 1. ESTIMATES OF HIGHEST DEGREE HELD BY LICENSED AMERICAN DENTAL HYGIENISTS, 1979.

There may be some bright spots as well. First, it is encouraging to note that dental hygienists with master or doctorate level training constitute 2.9 per cent of licensed dental hygienists. Second, it could be that in the aggregate, the percentage of hygienists with a bachelor degree or higher is growing relative to the total. If this is so then one can be a bit more optimistic about the future for dental hygiene research. Third, it may be that some schools of public health may enrol dental hygienists into programs leading to the Master of Public Health. While the MPH is far from a research training degree, it at least gets dental hygienists into the stream which may lead to further research training.

Turning to the Canadian situation, the picture is at present a little dimmer. Figure 2 is based upon the 1979 Canada-wide survey of dental hygienists undertaken by Professor Don Lewis and colleagues with the help of the Canadian Dental Hygienists' Association.[23]

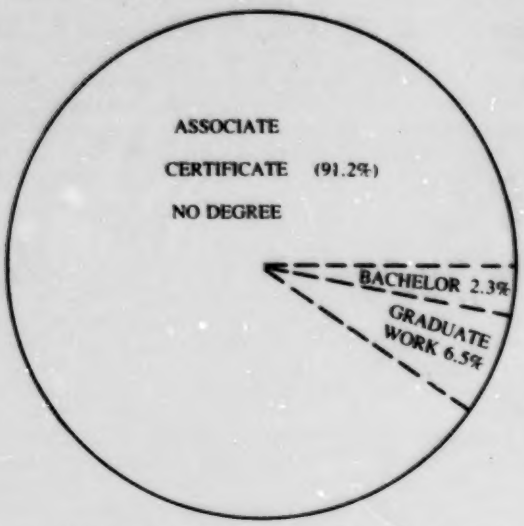

FIGURE 2. ESTIMATES OF HIGHEST DEGREE HELD BY LICENSED CANADIAN DENTAL HYGIENISTS, 1979.

As I have drawn the chart, it shows that only 2.3 per cent of Canadian dental hygienists have a university degree. Further, 6.5 per cent of hygienists indicated they took some form of unspecified graduate work. The use of broken lines within the circle is to indicate that my interpretations of the data may be questioned. In particular, it is not completely clear whether the 2.3 per cent refers to dental hygienists who graduated with a BSc in dental hygiene or to hygienists with a bachelor degree. Most pertinent, either interpretation will not affect the figure very much. Second, it is certain that the 6.5 per cent of hygienists with some graduate work cannot be interpreted as having a graduate degree. In reality, the per cent of hygienists with graduate degrees will be much lower than those with the bachelor's qualification. Further, in this diagram the bachelor and graduate categories are not mutually exclusive; indeed, they are probably completely overlapping.

It strikes me, therefore, that with respect to scholarly research, dental hygienists, particularly those in Canada, find themselves hemmed in. Not only do the vast majority of dental hygienists lack a baccalaureate degree with which they might go on to take advanced degrees involving research training, but recent public policy has been to locate dental hygiene education at the community college level. In the near term, this will be a difficult trend to reverse, particularly in unhealthy economic times.

Institutional Affiliation. The institutions in which dental hygiene education programs are located have a bearing on both the opportunities to conduct research and the scientific environment which will influence the researchers. In Canada, the opportunities to conduct research may be limited by the fact that most if not all community college-based researchers will not qualify for Medical Research Council funding. Hence one of the important sources of financial support for biomedical research in Canada may simply not be available to dental hygienists. The positions taken by other agencies which support health research must be examined on a case by case basis. While I do not intend to identify them all, some of the major Canadian agencies which may fund dental hygienists include the National Health Research and Development Program, the Health Promotion Directorate, the various provincial health research granting agencies as well as private foundations.

An important additional factor linked to the institutional setting of the researcher is the scientific environment which, it seems to me, profoundly influences the standards and credibility of research. I believe it is for these reasons that nursing, which has also experienced the shift to the community colleges, has so strenuously fought to retain and even expand its position in the university setting. If my assumptions are correct, the issue of institutional setting should be of considerable concern to hygiene leaders as they debate the prospects of research. Speaking strategically, it is not an issue that can, simply for convenience, be avoided.

Placing Personnel Training Ahead of Doing Research. Another element of strategic importance for developing a research orientation in dental hygiene that will be credible to the outside, requires the according of highest priority to the proper research training of dental hygienists. Scholarly research is inseparably linked with the qualifications and qualities of the investigators. Hence the challenge for dental hygiene, at the organization level, will be not to identify projects for research but to plan for the development of human resources capable of conducting research.

There are a few points that I would like to emphasize in this connection. Perhaps the first should be that the standards for good research are continuously being raised in the health field generally and the dental health field particularly. As I look around my own discipline of epidemiology and statistics, I can attest to the fact that the methods and techniques have altered markedly over the last 15 years, and where I thought dentistry was catching up in the early 1970s, I sense it is now falling behind the steady progression of ever more sophisticated methodology in these two fields. The implication for dental hygiene research training is that it should not look for guidance from departments or programs whose own methodologies are rapidly being outdated or, more commonly, are simply insufficient for the research task at hand. Second, it follows that dental hygienists whose academic background is sufficient to gain admittance to graduate programs should seek out those with a proven research orientation. Only in this way will the aspiring researcher receive the firsthand experience so vital to the development of successful investigators. Third, it is a personal view that to be successful in the competitive world of research, it is almost essential to possess PhD level training. The two major outputs of good PhD programs are: one, carefully crafted, narrow but deep investigations which contribute to the advancement of knowledge; and two, a set of tested and refined analytical tools which are passed on from senior to junior investigator. In a practical context, I consider this second task to be more important than the first. In short, the main objective for the aspiring dental hygiene researcher should be not only the content area of the graduate program but also the acquisition of the modern tools with which research can be successfully carried out in any number of settings. By and large this requires PhD level training.

Research Orientation. The fourth point of strategy deals with the question of choosing an appropriate general orientation for dental hygiene research. Ideally, dental hygienists should be active in any dental health research area they choose, from which it follows that they should acquire any type of relevant graduate research training they desire. But I believe this would excessively dilute the activities of dental hygiene research. Thus, I would respectfully suggest that where a choice exists, dental hygienists choose to develop their careers in the general area of health services research. Of course, basic and clinical research is highly appropriate to dental hygienists as well, but I do have some reasons for favouring my suggestions. First, health service research is generally a collaborative effort, often and increasingly involving interdisciplinary research. I believe this promotes continued learning in research and represents a natural way to broaden one's scientific horizons. Second, health services research is more receptive to a wide range of investigators and disciplines. Dental hygiene has a better chance of flourishing in that sort of an environment. However, a third point should not be forgotten, namely that health services research requires extremely high methodological sophistication if its outputs are to have credibility. It follows that dental hygienists must commit themselves to such a standard if they wish to function as effective researchers.

It may be argued that my strategy fails to recognize the need to walk before being able to run. I would like to preempt that view by saying that I consider university-based graduate training to be the walking phase and full-fledged collaborative, interdisciplinary research to be the metaphorical running component in the research enterprise. As Derek de Solla Price[24] has so compellingly shown in his highly influential volume, *Little Science, Big Science*, the nature of research and science has altered dramatically in recent decades and it benefits no one, least of all dental hygienists, if the research orientation is set in the wrong direction or aimed at an insufficiently high standard.

Summary

That represents the substantive portion of my presentation and I now would like to emphasize the main points I have tried to make by recapitulating in a summary form. I tried to confine my talk to a discussion of three major themes. The *first* of these was that in the health field, research is an important component in the professionalization process. In this context I first pointed out that an aspiring occupation must have a clear and analytically tractable notion of what a profession is. Second, since the service or consulting occupations cannot force society to confer professional status, professionalism can only be attracted by the establishment of a convincing knowledge base and a strong service commitment. Third, and most relevant to the conference today, I indicated that research is a key ingredient for expanding the knowledge base and developing the critical technology for an aspiring profession in the health area.

I then launched into my *second* theme which posed the question of whether dental hygiene is a discipline with an inherent theory and/or an area for study and research. With respect to this question, I made two points. I indicated that the question I posed must be squarely faced and openly debated by dental hygiene because of the crucial relevance to the research orientation that organized dental hygiene might take. Second, I indicated that nursing has chosen to claim a unique theory base for itself, thereby claiming to be a discipline. Whether one agrees with this or not, I provided three reasons why dental hygiene might not wish to choose the nursing model. These reasons related to the vastly different manpower situation (5 nurses per 1 physician versus 1 dental hygienist for 4 dentists), to the considerable differences in licensing and work structures, and to the potential problem with what I called "advocacy research."

My *third* theme related to strategic planning to enhance research in dental hygiene. I saw a number of obvious problems that would have to be squarely faced by any realistic planning process. Particularly, the issue of the first degree for dental hygienists together with the question of institutional affiliation were, in my view, quite significant. Further, these two issues loomed larger in Canada than in the U.S.A. Second, I suggested a number of reasons why in the short to medium term virtually all the emphasis should be on personnel training in order to produce a talented, properly equipped cadre of investigators who could perform credible research in the dental hygiene field. Finally, I suggested that dental hygiene should perhaps concentrate its research orientation in a number of ways. Of particular importance was that projects be collaborative, interdisciplinary in nature, relatively large in scope and possibly in the area of health services research.

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TOWARD A CLEARER UNDERSTANDING OF DENTAL HYGIENE RESEARCH, THEORY AND PRACTICE

Michele Leonardi Darby

Introduction

Since the word "profession" first came into use in the mid-fifteenth century, it has been used to denote a learned vocation.[1] Glaser has defined profession as "a cohesive and autonomous body of trained persons who perform work for the benefit of the public on the basis of applied scientific knowledge."[2] While scholars may differ to some extent on the distinguishing characteristics of a profession, there is universal agreement that a theoretical body of knowledge is an essential attribute.[1,3] A theoretical body of knowledge is the product of science that describes some specific aspect of the universe. Thus, we speak of the science of chemistry or the science of physics to refer to the accumulated body of knowledge of those disciplines which has been established and tested through research.

Research is the hallmark of a true profession, for it is through research that advancements and improvements in a profession's service role to the public are achieved.

> "Scientific research is characterized by a clear theoretical base, by systematic and controlled study of concepts and their connections and by critical appraisal of study designs and findings. The purpose of research is to build and test theory."[4]

Research provides the mechanism for defining and refining a body of knowledge signifying the growth of a profession. Research enables us to document occurrences in the real world, and hence, enables us to predict and explain those occurrences. Research enables us to define the scientific basis underlying dental hygiene practice and makes us more certain about the purpose and outcome of our services and more confident as practitioners. Research will enable dental hygiene to move toward the acquisition of full professional status. Knowledge derived from dental hygiene research has the potential of moving dental hygiene from a technical occupation to a profession.

Traditionally, dental hygiene has been defined according to political trends in health care. Our role has been discussed, debated and explained according to the changing policies and politics of professional organizations, state laws, and government agencies. Although we have numerous definitions of dental hygiene, we have little agreement regarding the nature of dental hygiene or the knowledge which provides its scientific base. In fact, close scrutiny reveals that the definitions delineate the function of dental hygienists rather than the content of dental hygiene as a discipline. Dental hygiene is a field of practice without a scientific heritage, poorly defined in practical terms and without a common research orientation. Consequently, this situation has inhibited the development of dental hygiene as a true profession and science, and has left dental hygiene feeling as a second class discipline, viewed by the public and other professions as an auxiliary occupation and not a true profession.

We are at a point along a continuum of professional maturation where we must assess the need for the development of an integrated body of dental hygiene knowledge and plan strategies for the development of this knowledge. This contention is based on the fact that currently there are no widely accepted concepts, propositions or theories that are widely accepted as the rudiments of dental hygiene science. Few studies exist on the practice of dental hygiene or the effect of dental hygiene services on the oral health of the public. Dental hygiene research priorities have not been developed and studies have been sporadic and isolated and have not built one upon another to develop an organized body of knowledge. Granted, the number of studies completed by dental hygienists about dental hygiene has increased; however, the most useful product of research, namely, growth in scientifically sound knowledge on which to base dental hygiene practice and education, is lacking.

If we measured the professional and scientific progress of dental hygiene to date, we would probably find that little has changed and that our practice is still a routine and ritualistic laundry list of functions rather than a process of care that is grounded in research and theory.

The purpose of the paper is to explore the interdependence between dental hygiene research and theory and to advance a basic thesis — that dental hygiene research and theory development are essential to dental hygiene practice and professionalization.

Value of Research to Dental Hygiene

Dental hygiene is an emerging profession. If dental hygiene is to evolve into a true profession and valid scientific discipline, dental hygienists will have to identify concepts, develop theories, and establish research priorities specific to dental hygiene in order to develop the body of knowledge on which our profession is based.

The uniqueness and value of the dental hygiene profession will emerge only when a distinct body of knowledge about the individuals, groups, situations and events of interest to dental hygiene practice are identified. What is dental hygiene? What is the nature of the service dental hygiene offers? What type of knowledge is needed to improve practice? What phenomena must be studied and what kinds of questions must be asked to develop the needed knowledge? Understanding and being able to make predictions about these things will move dental hygiene from a trial and error practice to one whose contribution can be quantified, measured and evaluated.

A profession is responsible for creating and constantly enlarging the body of knowledge upon which its service depends. Merton once said:

> A profession not rooted in systematic knowledge is a self-contradiction, a myth rather than a reality... the provision of research personnel and resources is one of the great requirements of a profession. No profession has ever advanced rapidly without including people who devote all or part of their time to methodical investigation.... As the profession accumulates distinctive knowledge and distinctive applications of existing knowledge, it gains in autonomy and relative independence, another of the hallmarks of a fullfledged profession.[5]

Unfortunately, many dental hygienists view research as an esoteric endeavor which is done by a select few; others believe research to be something quite distinct and remote from dental hygiene practice; still others believe it is a job for those confined to the ivory towers of academe, far removed from the realities faced by the practising dental hygienist.

Actually, the greatest value of research is in its contribution to a body of knowledge that can be used by the practitioner. Given the responsibility of serving the public, members of a profession are obligated to develop the theoretical and technological means by which this responsibility can be met. Society has a right to expect that dental hygiene care is delivered by individuals who possess a substantial theoretical foundation for making judgments, for improving health care delivery and assuming responsibility. In fact, "a practice devoid of theoretically sound, empirically validated processes may soon be considered unethical."[4] Therefore, a profession's research efforts are closely linked with its service role, responsibility and accountability to the public.

Lindeman, a nurse researcher, made this statement about research which I have adapted to dental hygiene: "If we are to become truly professional, research must be an integral part of [dental hygiene's] function, structure, nature and responsibility."[6] Research will enable dental hygiene to generate and refine the knowledge base needed for

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effective practice; in fact, practice will be only as good as the research and theory base that supports it.[7]

Value of Theory to Dental Hygiene

Once we accept the notion of the need for the development of dental hygiene knowledge through research, we find ourselves confronting the related issue of dental hygiene theory development. This issue raises several questions: What is theory? What is dental hygiene theory? How do we begin to develop dental hygiene theory? How does dental hygiene theory affect dental hygiene practice? These basic questions reveal the complexity and the challenge facing the profession in this area.

What is Theory? Isolated facts are of little value to scientists; therefore, researchers try to organize the knowledge of their respective fields so that the phenomena with which they are concerned are systematically related to one another.[8] "Scientific knowledge is systematically organized into theory."[8]

Theory, the basis of any science, can be defined as a set of interrelated concepts that provide a systematic view of phenomena.[9] Concepts comprise the subject matter of theory. "Concepts are generalized abstractions of reality formed from our perceptions of the observed phenomena."[9] A theory links together concepts and propositions about those concepts in order to describe, explain or predict a phenomenon.[4] The purpose of theory is to explain relevant events in the world.[4]

What is Dental Hygiene Theory? With this information in mind, dental hygiene theory can be defined as interrelated concepts basic to dental hygiene that can be used to systematically explain approaches to dental hygiene care and predict the outcome of that care. Concepts in dental hygiene provide the framework for the development of dental hygiene theory. In an emerging discipline, such as dental hygiene, theory provides a body of knowledge which can be used to guide and direct the practice of its members.[10]

To prevent the mere generation of isolated information, research must be guided by theory. Research that is well grounded in theory will have certain identifiable characteristics. First, a good investigation will be based on specific theories that define the concepts and their relationship to the research problem. The researcher will clarify the relationship of the research problem to the pertinent theory and, as such is clearly involved in the extension of science. Second, the researcher will use concepts that have been previously validated through testing to ensure that the research is not isolated from the current theory in the field. Third, after the research is conducted, the results will be explained in terms of their relationship to the works of others in the field. The researcher will actually comment on whether results agree with or refute the current knowledge in the discipline. And fourth, the researcher will identify new concepts, questions, and relationships that must be tested within the theoretical framework. Once validated these research findings are used to modify the theory which is then tested in future research.

> Science is cumulative, meaning that one scientist's work builds upon, extends and modifies the body of knowledge developed by other scientists. This cumulative nature of science is facilitated when each researcher tries systematically to relate what he is doing to what others have learned, through the use and modification of theories."[8]

"In essence theory directs research and research findings shape the development of theory."[11]

How can Dental Hygiene Theory be Developed? "The process of theory construction plays an important role in guiding research by pointing out the areas that are most likely to produce meaningful relationships among the phenomena being studied."[9,10] Theory provides a framework for explaining phenomena, predicting outcomes and testing hypotheses.

> Theory development also tends to summarize and order the research findings so that the profession is continually aware of the rapid changes taking place within itself. Since change is a continuous process, the profession must be continually reevaluating its concepts and theories.[9]

Although theory development is approached differently by various researchers,[8,12,13] most agree on four stages of theory construction: 1) describing the phenomena related to the particular field of inquiry; 2) specifying, defining, and classifying the concepts used in describing the phenomena; 3) developing statements which propose how concepts are interrelated; and 4) specifying how the statements or propositions relate to each other in a systematic and logical way.[9]

We at Old Dominion University are currently involved in the development of a theory on the use of the oral prophylaxis in children. I would like to share our experience to illustrate a theory in progress within the context of the four stages of theory construction.

Describing the phenomena related to the particular field of inquiry is essential to theory development and research. Through our observation and experience, we found little evidence to demonstrate that the rubber cup prophylaxis is a useful preventive service for improving children's oral health status or self-care behavior. Furthermore, we found little in the literature to support the traditional use of the oral prophylaxis in all types of patients. This first step led us to ask some pertinent questions. What is the effect of the professionally-administered prophylaxis on the oral health status of children? What is the effect of the self-administered prophylaxis (toothbrush prophylaxis) on the oral health status and self-care behavior of children? What effect do self-administered prophylaxes and professionally-administered prophylaxes have on the motivation of the child to maintain oral health? From this step, we had to *specify and define the concepts used to describe the phenomenon*. "Since a theory states a specific relationship between two or more concepts, definitions of concepts and related terms are necessary."[14] In this situation we had to operationally define children, professionally-administered prophylaxis, self-administered prophylaxis, oral health status, self-care and motivation. Concepts vary from those that are directly observable to those that can be observed indirectly. For example, the concepts of professionally-administered prophylaxis and self-administered prophylaxis are directly observable, but the concepts (constructs) of self-care and motivation are not. The researcher defines the concepts and constructs as they will be measured and congruent with how they are depicted in the theory. An important point to remember is that the same concepts and constructs can be defined differently in different theories. Hence, definitions of concepts relevant to dental hygiene may differ to varying degrees and thereby would provide the basis for differing theories within the context of dental hygiene science. Although the dental hygiene treatment goal is usually the same — maintenance of optimum oral health — the strategy for achieving the goal will vary depending on the dental hygiene theory applied.

The third step, *developing statements which propose how concepts are interrelated*, involves the development of propositions or hypotheses. A proposition or hypothesis is a statement which outlines the relationship between two or more concepts. Such statements allow for varying degrees of prediction about the real world. In our research, one hypothesis was that the self-administered prophylaxis is more effective than the professionally-administered prophylaxis in improving the child's self-care behaviors.

The last step of theory development involves the process of *interrelating propositions to form the theory*. The theory then encompasses several propositions to explain a phenomenon. Once several of the hypotheses or propositions are tested, the validated relationships can then be organized to form the rudiments of our theory on the use of the oral prophylaxis in children.

> Certainly, the process of theory development does not proceed in a linear fashion but necessitates feedback from all levels in a continuous evaluation of the factors of study and their relationship...[14]

Therefore, theories are always at various stages of development. The process of theory development is continuous and the nature of knowledge is always changing.

How can Dental Hygiene Theory affect Dental Hygiene Practice?

Emerging professions like dental hygiene have been characterized by drawing heavily from other disciplines to derive their bodies of knowledge. For example, historically, dental hygiene knowledge has

been closely linked with the growth of knowledge in the social sciences, basic sciences, medicine and dentistry. In the early years of establishing a professional identity, dental hygienists attempted to improve their professional status by preparing better teachers of dental hygiene. Subsequently, leaders in dental hygiene turned to academicians in the field of education to prepare their teachers. Given dental hygiene's relationship with other disciplines, it is understandable that dental hygiene researchers, as relative newcomers to the methods of scientific inquiry, have adopted the methods of these disciplines. Currently, most research conducted by dental hygienists takes place within the theoretical framework of disciplines such as psychology, sociology, education or the basic sciences.

Although these disciplines provide an important knowledge base for dental hygiene, there are fundamental fallacies in establishing dental hygiene practice solely on borrowed concepts, principles and theories. The fallacy lies in what is being borrowed and how it is being applied. For example, are the concepts and theories from other disciplines selectively taken to educate dental hygienists to some scientific knowledge or are the concepts and theories being used in the actual study of the dental hygiene process. In reality, dental hygiene knowledge is often viewed as a conglomeration of knowledge taken from other disciplines. The dental hygiene process of care is not the subject of the study, but rather the environment for studying phenomena pertinent to another discipline. In dental hygiene, we frequently draw upon theories from other disciplines, eg. communications theories, motivational theories and teaching/learning theories just to mention a few. Dental hygienists will continue to use the knowledge generated by other disciplines; however, in this use, we cannot neglect the development of theory about dental hygiene care. Dental hygiene theory development could help dental hygienists move out of the subservient role of practising from the perspective of another profession.

While the development of dental hygiene theory is essential to the establishment of a body of knowledge unique to dental hygiene as a science, this is not its only function. Rather than personal intuition, habit or tradition, theory development must serve as a basis for dental hygiene practice, making it scientific and less ritualistic. In contrast, a strong theoretical base of knowledge, derived from research, provides the rationale upon which dental hygiene interventions are planned, implemented and evaluated by the dental hygienist. As such, theories serve to improve dental hygiene care and enable us to more confidently predict the outcome of that care. Moreover, theories provide a source of hypotheses that can then be communicated and tested in future research. Validation of theories through research contributes to the body of knowledge and leads to the development of other theories and greater knowledge base for dental hygiene practice and education.

The nursing profession has gone through a similar evolution toward professional maturation and serves as an interesting model for dental hygiene to view. For example, in developing theory, nursing has identified four major components of nursing practice that any theory of nursing should address.[15] These include the concepts of person, environment, health and nursing. In addition to identifying these major concepts, some nurse theorists have outlined what each of the major concepts must encompass to be useful to nursing. For example, persons must be defined as being human beings as well as patients in need of nursing service. Nursing must be defined as something unique from other professional health services and health must be defined in terms of health and illness because nursing occurs in both of these dimensions.[15]

In dental hygiene, we too need to identify concepts central to our practice. Similarly, dental hygiene concepts need to be developed that fit the realities of dental hygiene in a variety of settings. The concepts of person, environment, oral health and dental hygiene serve as a good start. Such concepts, once defined, provide the first stage of dental hygiene theory development. Specifically, dental hygiene theories must include concepts of dental hygiene and explain or predict how dental hygiene actions affect or interrelate with other concepts to achieve the desired goal with the patient.[15] For theory to be dental hygiene theory, it must go beyond describing, explaining and predicting a particular phenomenon. It must delineate and validate the actions necessary to promote oral health, one of the purposes of dental hygiene. The following example illustrates a simple dental hygiene theory used to guide a dental hygienist action. Think about the situation where a dental hygienist is about to treat a patient who is anxious. Guided by theory which states the proposition that when a patient has an understanding of anticipated events, he will be less anxious concerning them, the dental hygienist provides the patient with a thorough description of the procedure and the dental instruments involved.[1] The goal of the dental hygienist in this situation is to reduce patient anxiety associated with dental hygiene treatment so that quality care can be rendered.

The process of synthesizing a dental hygiene theory is not always clear and the product is never complete. However, most researchers start by identifying that phenomenon that has always puzzled them. (Freud often stressed that his own theories grew out of his clinical experiences.) The concepts associated with the phenomenon are identified and defined based on the literature and experience. When the researcher is clear about the concept of concern, a thorough review of the literature is conducted to identify as many factors as possible that are related to the concept. After factors are identified, the researcher attempts to identify clues regarding the relationship among the factors. Out of this process the researcher decides on the relationship he/she wants to test and then proceeds with the investigation.

As dental hygiene theories (and the concepts and propositions that make them up) are enunciated and tested, the profession will be furnished with generalizations to solve the practical problems of dental hygiene practice. Dental hygiene theory can and should grow with our own clinical experience. The systematic study of the dental hygiene practice setting provides sources for dental hygiene theory development. Most dental hygienists have the potential to develop theories and dental hygienists working in various settings and with researchers from other disciplines are in a unique position to apply theory to their practice and to judge the efficacy of that theory in a given situation.

Dental hygiene researchers must start to build a body of scientifically tested dental hygiene theory from which may be drawn the facts, concepts and principles on which to base patient care. Dental hygiene theory would then provide a unified system for providing dental hygiene care. Dental hygiene theory would also provide the systematic body of knowledge which can be continuously tested and validated to ensure quality care to the public.

Recommendations

Dental hygienists share in the responsibility for advancing the theoretical body of dental hygiene knowledge. Considering the benefits to be derived from a strong research commitment, several recommendations are made to expedite the development of dental hygiene research and theory. We as dental hygiene researchers and potential theorists should initiate the following:

1. Identify concepts and relationships between concepts unique to dental hygiene practice. Rather than borrowing concepts and trying to make the concepts fit, this alternative allows the dental hygiene practice or educational situation to become the source for theory development. In freeing ourselves from the burden of always looking for applications of basic science or educational theories, we could assume the responsibility of developing dental hygiene science.
2. Define the scope of dental hygiene and the content of dental hygiene as a discipline. Concensus concerning the definition of dental hygiene might enable researchers to conceptualize about dental hygiene and develop relevant theories.
3. Encourage educators to teach dental hygiene as a process of care that is theory based. With this approach, dental hygienists will learn to consciously use theory derived from research to guide their practice.
4. Encourage dental hygienists in roles as educator, practitioner, manager and researcher, to formulate and articulate their own theories of dental hygiene relevant to their employment setting. We all have personal theories about what constitutes effective dental hygiene interventions; however, these theories are in the embryonic stages of development and need documentation and validation.
5. Involve dental hygienists in the setting of research priorities based upon the problems faced by dental hygienists.

6. Promote dental hygiene research and analyze how our research contributes to the theoretical knowledge of dental hygiene.
7. Transmit the philosophy of the value of dental hygiene research and theory development to our educators so that they in turn can influence our students. Educators also need to encourage students to pursue rigorous research training at the masters and doctoral level.

As professional dental hygienists, we need to be able to identify theories that will assist us in rendering quality patient care and upon which we can build a strong rationale for our services. To render quality dental hygiene care, the dental hygienist needs a breadth of knowledge well grounded in theory and supported by research. The greater the dental hygienist's knowledge of the theories which influence dental hygiene care, the greater the potential for employing effective approaches to care. Research will enable us to describe and classify approaches to practice, test hypotheses derived from theory and build a more scientific basis for practice and a body of knowledge unique to dental hygiene. "The essence of a professional is to use theories of the discipline to practise the profession."[6] Dental hygiene will not reach its full potential as a profession unless we develop, support, and use a knowledge base for professional dental hygiene practice. Therefore, we must begin the hard job of developing dental hygiene theories, validating these theories through research and consciously applying this knowledge to practice.

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DENTAL HYGIENE RESEARCH DEVELOPMENT OF ADHA: 1977-1982

Denise O'Brien

Introduction

This paper will discuss the national efforts of the American Dental Hygienists' Association toward the development of dental hygiene research from 1977 to 1982. A brief description of the nature of the problem will provide an understanding of the impetus which preceded efforts by the professional association.

Nature of the Lack of Dental Hygiene Research

Dental hygiene educators recognized that dental hygienists needed increasingly to assume professional responsibilities for research.[1] A review of the literature in the nursing profession identified problems of remarkble similarity to the lack of research development in dental hygiene.[2,3] In the words of a nurse-reseacher,

> The concept of nursing that came to take precedence in the minds of nurses themselves, of physicians, and of the public was that of a person who takes care of sick people and *who meticulously follows directions of physicians and other authority figures*.[2]

Similarly, dental hygienists have been visualized as persons who perform set procedures according to the dictates of the dentist. This view of health care assumes that a "higher authority" is able to provide all the answers and that we do not need to ask questions ourselves. Obviously, this orientation does not provide an emphasis toward scientific investigation of the nature of the problems in dental hygiene practice. Rather than assuming an active role in the inquiry of the science and art of dental hygiene, dental hygienists have traditionally been given "bodies of knowledge handed down from authorities above."[4]

Study of the Attitudes toward Dental Hygiene Research

In the late 1970s, the Committee on Research of the American Dental Hygienists' Association (ADHA) studied the problem of the lack of orientation toward scientific inquiry in dental hygiene. Since dental hygiene educators and educational institutions shape the development of the attitudes, knowledge, and skills of the dental hygienist, it was most important to determine the attitudes of dental hygiene faculty toward research. In 1978-79, all dental hygiene program directors were surveyed to determine attitudes toward research and level of research training in the associate, baccalaureate, and master's degree-level programs.[5] Results of this survey suggested two significant factors. The majority of baccalaureate and master's degree program directors perceived education in research methodology or critical analysis of scientific literature as important for dental hygienists. Alternatively, two-year institutions and baccalaureate programs reported that the curricular requirements in dental hygiene did not allow for training in research.[5]

These results supported the interest of faculty and the need for organized efforts to encourage research in dental hygiene.

Efforts of Committee on Research, 1977-1979

Efforts of the Committee on Research from 1977 to 1979 resulted in the sponsoring of workshops on research methods and scientific analysis, articles on research methodology in the journal, *Dental Hygiene*, and establishment of a Research Grant Award Fund by the ADHA Foundation.[6,7]

Dental Hygiene Research Grant Award Fund

Establishment of the Research Grant Award is of particular significance for several reasons:

1. The fund demonstrates a formalized system of support capable of providing for organized and continuing research efforts.
2. The fund illustrates recognition of the importance of research by the dental hygiene profession itself.
3. The fund is the only source of grant monies specifically for dental hygiene research (Eligibility requirements specify that the principal investigator be a licensed dental hygienist).
4. The fund provides a mechanism for directing research efforts toward identified areas of specific concern within dental hygiene.

The 1980 Council on Educational Services and Research of the ADHA formulated three areas in which scientific investigation is needed in dental hygiene.[8] These areas were incorporated into the evaluation criteria and established as priorities for funding of the Research Grant Award by the Foundation Board of Directors in 1981.[9] The research priorities are:

1. Quality of patient care — as it relates to the access of care, the methodology of care and alterations in the practice setting.
2. Effectiveness of continuing education — the relationship of continuing education to behavior change, studies of long-term retention, determination of whether or not continuing education increases the quality of patient care or patient education.
3. Dental hygiene practice — the existing scope and knowledge base, relationship to the various educational levels in dental hygiene programs (i.e. certificate, bachelor's, master's).[10]

The establishment of priorities has become effective only within the last year. Therefore, research studies which have been funded to date do not reflect any specific subject content priority. (A listing of the seven studies funded to date is available from ADHA).

The Research Grant Award stipulates that the ADHA has first publication rights to the research report. In this way, the fund can also contribute toward the number of original research articles available to the Association journal.[10]

Perhaps the greatest potential significance of the Research Grant Award Fund is its stated purpose of supporting research which investigates the knowledge base of dental hygiene practice. The success of the fund to this end will not be apparent for several years to come.

Research Initiative

The establishment of the Research Grant Award Fund was one aspect of overall efforts to support dental hygiene research through the ADHA. The Committee on Research in 1978-79 also laid plans for a "research initiative" which was visualized as a long-term, systematic, continuing effort to develop research within the dental hygiene profession.[6]

The initial requirement was to select a task force of experienced researchers, professionally committed to the advancement of dental hygiene. Five researchers, with extensive research and publication experience in clinical sciences, education, public health, and the social sciences were appointed by the Foundation Board of Directors in 1980 to plan and oversee activities of the Research Initiative.

The Research Initiative Task Force met in November 1980. Information available to the task force included literature on research strategies of the nursing profession, a grant proposal which outlined the nature of the problem to be addressed and possible goals, and information regarding a "Survey of Dental Researchers in the U.S.A." Objective information regarding dental hygiene researchers, training capabilities, research opportunities, and types of research being conducted was nonexistent.

Based upon the identified need for descriptive data, the first goal identified was the overwhelming need for all types of information relating to dental hygienists' research activities. Some of the questions raised may be of interest to dental hygienists in Canada who are undertaking similar data-gathering studies. These questions can be categorized as information regarding personal data, educational support, career development, grant funding availability, and employment opportunities.[11]

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Personal Information. The types of questions asked regarding personal data sought to correlate such characteristics as socioeconomic status, age, educational level, and demographics with the practice of research by dental hygienists.

Educational Support. Questions asked regarding educational support included: What credentials are necessary to engage in research? Where do dental hygienists receive research training? What special educational experiences might enhance interest in research? What financial support is available for advanced education? These questions seek to identify the various educational pathways which might encourage a research orientation in dental hygiene and to identify the types of research being conducted at various academic levels.

Career Development. Career-development questions centered on the dental hygienists' attitudes, interests, motivation, and social status as women. Do dental hygienists experience barriers in advanced educational opportunities? If so, what types of factors can reduce these barriers? What other factors influence dental hygienists toward research activities? Do dental hygienists with advanced degrees progress "outside the field" or do they contribute to a body of knowledge in dental hygiene? Do dental hygiene researchers consider research activities to be vital to the profession of dental hygiene? At what level do dental hygiene researchers participate in conferences, associations, and journal review boards? What are the researchers' special areas of interest?

The career development questions seek to relate the professional activities of the dental hygienists to the attitudes of the individuals and the barriers they perceive to exist.

Grant Funding. Questions regarding grant funding are fundamental, as the conduct of research is directly dependent on the monetary support available. Pertinent questions raised addressed the amount, types, and sources of funds available to dental hygienists. This data also seek to determine if dental hygienists are being funded as principal investigators, and to what degree.

Employment Opportunities. Questions related to employment opportunities include: where are dental hygiene researchers employed? what other employment opportunities are available? what level of support for research is provided in the employment situation?

As the previous questions illustrate, the Research Initiative Task Force outlined a very comprehensive area for future investigation. The content draft of a questionnaire was well under way.

Along with plans for a descriptive survey, the task force also formalized a definition of research, the mission of the Research Initiative, and 10 long-range goals of the project. This information may be useful to dental hygienists in Canada who wish to conduct programs in this area.

Research is defined as the critical, systematic, and exhaustive investigation or experimentation having for its aim the discovery of new facts or knowledge, their interpretation, and the revision of accepted conclusions, theories, or laws in the light of newly-discovered facts. In light of this definition, the ongoing mission of the American Dental Hygienists' Association's Research Initiative is to foster research, promote the exchange of research information among members of the dental hygiene profession, and develop mechanisms that will increase and improve research activities within the profession. The goals of the Research Initiative are as follows:

1. Plan mechanisms or strategies that have the potential of increasing the research capabilities of individuals in the dental hygiene profession.
   a. Identify potential sources of support for research training grants.
   b. Explore positions for dental hygienists in the National Institute of Dental Research and other appropriate agencies for research training programs.
   c. Develop guidelines for the incorporation of research information in the educational system.
   d. Facilitate research conferences for dental hygiene educators at regional research institute centres.
2. Foster research to broaden the base of knowledge of members of the dental hygiene profession.
3. Promote the utilization/application of research findings in dental hygiene.
4. Develop guidelines for instruction in research methodology in the education of dental hygienists.
5. Encourage the development of continuing education programs to:
   a. apply research findings to dental hygiene practice;
   b. help dental hygienists become discriminating consumers of research findings; and
   c. stimulate dental hygienists to conduct research.
6. Promote the development of programs to meet the need for training dental hygiene educators in research.
7. Survey the status of research by dental hygienists, numbers of qualified researchers, and the research training capabilities of institutions.
8. Promote a research effort in dental hygiene through administrative, educational, and financial support.
9. Improve the quality of research publications by supporting a referee system of manuscript review.
10. Establish a dental hygiene research forum to provide opportunities to disseminate research findings.[12]

Research Initiative Projects, 1980-1982

Again, the task force had been very ambitious in establishing ADHA Research Initiative goals. Two goals were set to be realized by 1982: the completion of a descriptive survey of dental hygiene researchers, and a research forum, or conference, for dental hygienists to present their research findings.

Survey of Dental Hygiene Researchers. The initial problem with the survey of dental hygiene researchers was the identification of the researchers themselves. Advertisements placed in ADHA publications asked dental hygienists involved in research to identify themselves. Respondents simply had to fill in their names and addresses and return a tear-out form. Approximately 180 dental hygienists responded. This listing, however arbitrary, was one expedient way of reaching the potential research community. Questionnaires were pretested, revised, and sent in the spring of 1982. Results of the survey are not yet available. (Preliminary information may be available through the ADHA central office.)

Research Forum. In June 1982 the first ADHA Research Forum was held in conjunction with the Association's meeting. (A listing of research papers and presenters is available from ADHA for interested persons.) Selection of the papers was determined by the Research Initiative Task Force. Thirty-four abstracts were received. Eighteen of 22 selected papers were presented.[13] The papers represented varied subject-content in education, community health, radiology, fluoridation, and behavioral and clinical research. Interestingly, the greatest quantity of papers received were in the clinical and educational research categories. Investigators were largely academic faculty or recent graduate students.

Conclusion

In conclusion, this presentation catalogs five years of recent efforts of the American Dental Hygienists' Association Foundation to build ongoing, continued strategies for supporting dental hygiene research. To date these efforts have resulted in:

- workshops on research methodology;
- establishment of a Research Grand Award Fund;
- support of seven research projects through the Research Grant Award Fund;
- broad categories of national priorities for research;
- appointment of a Research Initiative Task Force to direct ongoing efforts;
- the first national ADHA Research Forum for dental hygienists, to be continued annually;
- a descriptive survey, "Dental Hygiene Researchers";
- a long-range plan for research development.

This progress is significant, as it illustrates a desire, on the part of dental hygienists, to assume professional responsibility for self-direction. Yet, in the larger sense of the ultimate goal of linking dental hygiene practice to theory, perhaps this progress is an embryo of what is needed to develop. Not unlike an embryo, the progress in dental

hygiene research is totally dependent upon the "caretakers" of the profession. To *be* a caretaker is the challenge I extend to you today.

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RESEARCH PRIORITIES IN DENTAL HYGIENE EDUCATION

Denise M. Bowen

In the process of developing issues, strategies and tactics for dental hygiene, our educational programs are a tremendous source and resource for meeting the challenge of dental hygiene practice in the future.[1] Educators bear a large portion of the responsibility for the preparation of health care professionals. Therefore, our ultimate goal is to graduate dental hygienists who are competent in providing quality services to the public.[2] Dental hygiene education needs constant introspection and questioning if we are to prepare our graduates to meet the challenges of the next decade.

Dental hygiene educators are asked to forecast the changes which are inevitable in our field and make some tentative suggestions about those areas which deserve attention in our nations' schools. The dental hygiene profession should make certain that all of its components join together in creating the future.[3] For this reason, we cannot polarize research in dental hygiene education from investigations relevant to dental hygiene practice. Let us be certain that we are creating an educational environment necessary for maximizing our potential.

The fundamental basis of changes in curriculum and educational programs should be based on data produced by research just as changes in clinical practice are generated through the discovery of new knowledge.[1] Educators must examine dental hygiene practice empirically in order to project and create improved methods for the delivery of optimum oral health services. It is the responsibility of our schools to explore new methods of detection, treatment and prevention of oral diseases; to examine current practices in terms of potential improvements; and to conduct various types of research that justify curricular changes.[4] If we do not accept this responsibility as educators and practitioners external agencies will dictate our curricular content and we will not shape our developing profession.

Dental hygiene programs should be designed to produce future practitioners who will be capable of rendering care in a rapidly changing delivery system. As we examine various practice alternatives and innovations we need to ask: 1. whether or not they are in the best interest of the patient and the provider; 2. whether or not they are enhancing or destroying our profession; and 3. whether or not they are permanent enough and critical enough to add to an already overcrowded curriculum.[5] The effort to expose our students to a variety of practice modes is escalating. Our students will benefit from this exposure and their practice perspectives and clinical expertise will be broadened.

In the past, the major thrust of the dental hygiene curriculum was based upon the traditional role of the dental hygienist, which was relatively standard. This role has been the basic unit of the dental hygiene profession and the objective of our curriculum. It is becoming apparent that being overconcerned with the relevance of our teaching to our definition of practice has led to emphasizing vocational competence rather than a method of thought and growth of dental hygiene science.[3] So, as we set priorities for research in dental hygiene education we must continue to study a variety of practice modes and methodologies with the goal of improving our service role to the public. The faculty at each school bears the responsibility for advancing the knowledge of dental hygiene practice and transmitting these strategies to our students.[6]

Research activities are beneficial to the general academic environment. An institution with an active research program provides a better teaching environment than those schools that are scientifically inactive. We must not only present our students with facts, but also with the process of science itself. Students who understand the scientific method ultimately can apply it as they grapple with new clinical problems and changing roles after graduation.[3]

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Yes, there is little debate that dental hygiene practice is changing — so what is the appropriate response of our educational programs?[7] Our aim should be to study dental hygiene education with both a scholarly and applied perspective.[6] The question is: What facets of dental hygiene education present our most pressing problems? The crowded curriculum is one. Some observers suggest that we (dental hygienists) are "overeducated." I believe that this is not the case. Dental education has had to assimilate a flood of information due to the explosion of knowledge in recent years.[1,8]

A survey of 194 dental hygiene curricula in the U.S. showed that 26 procedures or functions are included as an integral part of nearly every dental hygiene curriculum.[9] And, the tendency to continue to add new content areas in preparation for our changing role is growing. Will this morass of information be digested by our students in two years, or three years, or even four years of education? Or will it result in the dental hygiene practitioner who has had an overload of information perhaps to the detriment of professional competence and judgment?[1] We must begin to study the necessity and methodologies prerequisite to upgrading the educational level required for entry into the practice of dental hygiene.[6]

Clinical teaching and evaluation methodologies also are ripe for changing. We are facing problems of a decreasing patient pool in the face of increasing requirements and functions.[10] This dilemma leads to fragmented care and undue stress for students and faculty.

Additionally, dental hygiene educators need to conduct research that will lead to the development of objective criteria for evaluation of student performance, calibration of clinical faculty, sufficient feedback for student's self-assessment and procedures that facilitate qualitative judgments about both process and product.

We also need to examine the current state of student preparation and attitudes. What admissions criteria should be employed to select the future dental hygiene practitioner? What are valid predictors of performance in our education programs and, more importantly, success and gratification after graduation.[11] A need exists to study the aptitude and competencies required for a dental hygiene professional. And what better resource do we have than our graduates for answering questions regarding preparedness?

Alternative sources of revenue for dental hygiene education may be needed in the future. Our programs are not competitive in terms of cost efficiency. As budgetary demands increase and funding sources decrease, costs are transferred to the student, thereby narrowing our field of applicants and our potential for maintaining quality.[1,8]

Issues of manpower should be monitored to identify existing trends and project the direction of dental hygiene education. Data on the utilization of dental hygienists, employment opportunities, patterns of need and demand and distribution are needed for intelligent planning.

These questions, among a myriad of others, should be tested through the scientific method. We need to examine the discrepancy between what exists and what should be. The research data generated should be utilized to implement positive change. Once a new approach is implemented, new data must be generated to assess its effectiveness. If necessary, a new decision should be made.[12] But research data must be employed to guide the evaluation of our educational process.

Most dental hygiene faculty are not changed easily. The status quo is always most comfortable. Educational changes often are resisted in the name of scholarship or professionalism. But, we must remember that *true* scholarship, producing change through science, is required to improve our teaching effectiveness. It is an important challenge to both educators and students to learn how to obtain information, how to use and interpret it, and how to develop logical approaches to problem solution.[3]

All health professions are facing changing roles in the years ahead. We cannot afford to close off new ideas and expanded horizons

in hope that external factors will disappear. Change is not only inevitable, but essential. We do have a chance to make this challenge work for us. Anticipating changes in dental hygiene education will facilitate the evolution of dental hygiene practice and the ability of future graduates to survive these changes.

In closing, I would like to read a quote from Dr. William Mayo on his 70th birthday, 50 years ago:

> I realize that scientific truth which I formerly thought of as fixed, as though it could be weighed and measured, is changeable. Add a fact, change an outlook and you have new truth. Truth is a constant variable. We seek it, we find it, our viewpoint changes and the truth changes to meet it.[13]

Let us strive to continually test the many variables relevant to dental hygiene education so that we do not lose sight of the truth.

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RESEARCH IN DENTAL AUXILIARY EDUCATION

Don W. Lewis

I should forewarn you at the outset that I know little about this topic which was assigned to me — research on dental auxiliary education — from the curricular planner's or educational psychologist's viewpoint. Although I have done some dental manpower research on auxiliary utilization and recently surveyed dental hygiene practice in Canada, my only attempt at dental education research *per se* concerned a longitudinal assessment of entrance DAT scores of dental students with their subsequent performance in the Faculty of Dentistry at Toronto. My findings that DAT scores, even the technical ones, had very low relationships with later performance were not very popular as they went against the conventional wisdom. So don't expect much from me except, perhaps, a lack of conventionality. Fortunately, my two fellow panelists are directly connected with dental hygiene education so they'll be able to make up for my inadequacies.

In view of the stated practical objectives of this Conference and your need to identify and prioritize specific research topics following this panel, I decided that the best thing I could do was to describe a number of general areas in dental hygiene education I perceive need research. Interestingly, with my weak background, this required me to search the literature and talk to people in the field. I say "interestingly" because in any investigation this is exactly what a researcher should do, although a good researcher would not do the hurried, superficial job the available time has dictated to me and would ordinarily already be "steeped" in the field. And this is the first point I'd like to stress: to conduct good research requires a very thorough understanding of the interrelationships and complexities of the phenomenon under study and its measurement. There is no easy or other way. Also, we sometimes hear about serendipitous research findings — Fleming's discovery of penicillin mold is invariably mentioned. However, Rene Dubos[1] has clearly shown that this, even for the Fleming incident, is largely a myth. "Chance", Pasteur wrote, "favours only prepared minds."

Well, my brief search consisted of reading a few appropriate dental journals over the past few years, and re-examination of the proceedings of the 1974 Canadian Dental Association Conference on Dental Auxiliaries[2] and my own 1979 survey of dental hygienists in Canada.[6] Consistent with my background in dental public health and dental care services research, but perhaps reflecting the state of affairs as well, some areas I identified are issue-oriented and controversial.

I shall present the material that spawned for me, and maybe will for you, the research ideas and, later, some of the ideas themselves one by one and hang them randomly — remember randomness is next to godliness in research design — on to a mythical framework something like a child hanging various ornaments on a Christmas tree. Just as the child might, I shall do this without particular concern about whether the tree decorations are broken or the arrangement is patterned aesthetically. Your job, if you choose, will be to reposition the ornaments (research ideas) to achieve a more acceptable and practical pattern; to remove those that are useless since they are dated, broken or badly worn; and to replace them with newer, contemporary ones.

First I'd like to summarize what I believe were the dental auxiliary education and other issues arising from the 1974 Canadian Dental Association Conference on Dental Auxiliaries[2] which, incidentally, should be required reading for every dental hygiene student in Canada. Concerns in no priority order were expressed about:

1. staffing recruitment in institutions educating dental auxiliaries;
2. lack of national standards on dental auxiliary names, roles, tasks, duties;
3. low and inappropriate utilization of dental hygienists due to inadequate task delegation by their employer-dentists (leading, ironically, to the claim that hygienists are overtrained);
4. the need for continuing education for dental auxiliaries but especially for dentists in view of item 3 (which suggests dentists are undertrained);
5. the attitudes of practising dentists and also the public, government and dental educators about dental auxiliaries;
6. the lack of vertical and horizontal opportunities for dental auxiliaries which led to general approval of a career options approach to auxiliary education;
7. the range of duties that auxiliaries should undertake — although serial listing of permissible duties was not generally approved, there was no agreement on whether just reversible procedures on the one hand or any that the dentist would take responsibility for on the other, should be allowed;
8. whether supervision by a dentist should be general, by prescription, or direct and on site.

One working group at the conference inadvertently but eloquently summarized what maybe is needed regarding curricular change by suggesting that all dental auxiliary curricula should be burned and started over again from scratch.

Although this Conference[2] was a Canadian and, indeed, international landmark at that time in terms of the variety of persons involved and its open and far-reaching discussion, what major achievements have been made since then or, to take a four-year step backward, since the very progressive Well's Ad Hoc Committee Report[3] on dental auxiliaries of 1970? Other than the establishment of limited career option programs for auxiliary training and baseline task competencies for standardizing evaluation to licensure in two or three provinces, I believe very little has changed. In some respects the situation has worsened since we now hear of regional oversupply of hygienists and dentists and get predictions of decreased employment of dental hygienists as dentists perform these duties themselves to protect their share of what is perceived as a diminished patient pool. We find that, in at least one province, a specialty training module is equally open to both certified dental assistants and dental hygienists, and, in another, restorative dental therapists (nurses) can become hygienists after a number of months of extra training which, in my view, is out of order. Another continuing semantic anomaly which has not disappeared would seem to be the labelling of dental hygienists as over-qualified yet unable to work legally in a dentist's office even using simple procedures without the direct supervision of dentists in seven or eight of Canada's provinces.

In case the 1974 concerns just summarized don't sound familiar, let's play the record again only in deference to my fellow panelists from the United States. I will use the Minnesota label and a 1979 recording by Meskin[4]. Here are the issues that Minnesota dental hygienists identified as affecting their practice (from high to low):

1. Oversupply of dental hygienists;
2. No opportunity for career growth;
3. Overeducation — not allowed to perform up to legal potential;
4. Dental assistants performing many dental hygiene duties;
5. Inadequate employee benefits;
6. Domination of the dental hygiene profession by the dental profession;
7. Inadequate financial compensation;
8. Not being treated as a professional member of the dental team.

As with the 1974 CDA conference,[2] a number of nearly identical educational and manpower issues emerged. What else did I find in the journals that has research implications?

In the Winter 1981 *Canadian Dental Hygienist* a very interesting multivariate analysis of Canadian dental hygienists' attitudes to mandatory continuing education appeared.[5] Forgay's findings of low relationships between these attitudes and various demographic and other variables raised the intriguing question regarding what variables, if any, do relate. Leaving aside the mandatory aspect, the question of

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continuing education for dental hygienists is important because dental hygienists take so many such courses[6] and, despite limited evidence of dental success, the scientific measurement of the real importance of continuing education is not well documented nor the testing methods for it well established.[7] A very recent evaluation of a voluntary continuing education program brings up another issue. Minnesota hygienists, despite showing gains in knowledge of the periodontal procedures studied and in self-reported skill acquisition, six months later showed no change in simulated patient care, with a large proportion selecting the wrong instrument for treatment.[8]

Two other findings in recent issues of the *Canadian Dental Hygienist* relate to the concerns of the 1974 CDA Conference[2] enumerated earlier. The first of these is an excellent update by MacDonald and Miller[9] on the career options (COP) situation in Canada. Ending this review, which is a reassessment of the Canadian Dental Hygienists' Association position on COP, is a statement of continuing support for the COP system and a recommendation that "titles, names, and basic training of all auxiliaries should be the same across Canada" to facilitate geographic mobility. This recommendation seemed to support the fact that CDHA had already established a Task Force on Portability, complete with terms of reference.[10]

In 1981 a new CDHA position statement was announced promoting (1) curricular changes by dental hygiene educators to encourge greater utilization of hygienists in the provision of treatment to the elderly, chronically ill and handicapped, and (2) the development of community educational and preventive programs for these persons. In view of these initiatives it was interesting to read a recent study by Rakowski et al.[11] of the attitudes of graduating dental hygiene students. The authors indicated that the students' general attitudes toward the elderly were not strongly related to their perception of the elderly as dental patients. The study also found that those with greater contact with the elderly had better attitudes and speculated that the course teacher was an important role model. Interestingly in this same issue of the *Journal of Dental Education* a study of practising dentists reported no significant difference in attitudes towards the elderly between dentists who had and had not taken courses in geriatrics or in prosthodontics with a geriatric component.[12] Exposure to the elderly in terms of greater practice experience was claimed to be important in shaping favourable attitudes.[12]

Based on my literature several educational research ideas follow:

1. Delegation/utilization issues:
   a. Will implementation of continuing (and undergraduate) education for dentists help?
   b. What variables at the levels of the individual dental hygienist and dentist can be influenced by the admission and educational processes?
2. Continuing education issues:
   a. Does continuing education lead to altered and higher quality patient care?
   b. What kind of continuing education is most effective for patients and efficient for dental hygienists?
   c. Is further research on mandatory continuing education warranted?
3. Supervision issues:
   a. Curricular content analysis between dental hygiene and dental training for tasks performed in common with emphasis on scientific content, potential harm, etc.
   b. Comparisons between dental and dental hygiene students in the quality of patient diagnosis and history taking.[13]
   c. What medical emergencies related to dental hygiene care might arise?[14]
   d. Is more training beyond the diploma required?[14]
   e. Are any of the fundamental issues related to supervision amenable to alteration at the curricular level?
4. COP system/portability issues:
   a. Regarding the Portability Task Force, will an "integrative research review" — a rigorous form of non-primary research — reveal need for short-term regional rather than national portability goals?[15]
   b. In view of the dental assistant to dental hygienist vertical mobility of COP, does the actual process of care rendered by a typical dental assistant-dental hygienist differ from a dental hygienist alone and, if differences exist, are these equally in the best interests of dentists, hygienists and patients?
5. Curricular changes regarding the elderly, chronically ill and handicapped:
   a. What varying curricular content exists now and how do extant programs affect knowledge *and* practice?
   b. Comparisons of effect of different kinds of new courses and teachers.
   c. Will increased curricular exposure lead to greater postgraduation care or do other environmental barriers exist?
   d. What is the size and direction of the relationship between extent of nondental exposure to elderly and attitudes to them as persons and as dental patients?

The available time does not permit greater identification of potential material for research using journals. As mentioned earlier, I did consult with people about critical research problems in dental hygiene education and shall just mention three of these. The *first* is concerned about whether the change (in at least one Canadian hygiene program, but perhaps more) from a formal, structured, curriculum to an informal, open "learner-controlled" curriculum may be premature. My presumption is that the effectiveness of the latter format has not been established for educating dental hygienists whereas the former curriculum has. Perhaps the two curriculum formats should be properly compared. The *second* topic suggested the need for comprehensive dental hygiene task analyses in order to facilitate the development of competency performance, evaluative standards and national guidelines. Presumably educational research examining the congruence between these task requirements in the field and what is taught would be illuminating. The *third* suggested project, also identified at the 1974 CDA Conference[2], is a market survey of the need for advanced educational programs specifically for dental hygienists beyond the diploma level. Presumably such a study would determine the manpower needs for, and skills required of dental hygienists with extra training in fields such as education, administration and research.

Finally, three potential research areas that arose from our Dental Health Care Services Research Unit's 1979 survey of dental hygienists in Canada follow:[6]

1. Although nearly 60 per cent of respondents had graduated in the previous five years, 40 per cent of all respondents (a young group) had taken additional post-secondary education beyond their dental hygiene training.[6] Seventy-one per cent of this additional education was outside the dental field.[6] An in-depth survey of the reasons for this high level of extra education and the characteristics of those who have and have not done so would be interesting.
2. About 13 per cent of practising dental hygienists felt that the quality of their dental hygiene training was not good preparation for their present work.[6] Most but not all of this dissatisfaction was expressed by those not in private practice.[6] Study of the curricular and possibly noncurricular reasons for this in both private and public practice would be of interest.
3. The self-reported per cent of time dental hygienists spend in major areas of practice and the regularity of performance of specific duties, including expanded duties, within each of these major areas was documented.[6] What is the correspondence between educational emphasis on these areas and duties and this practice experience? Should there be close correspondence? Is re-examination of the expanded duties taught and practised needed?

I believe some of the needed ongoing educational research is common to that required of any post-secondary program, especially those that have a practical job orientation. However, there is a difference connected to the position of dental hygiene in the formal organization of dental care in Canada and the regulations governing dental hygiene practice. The dominant impression regarding the major issues affecting dental hygiene is their continuance over time without much change or even with increases in intensity. What we can infer from this pervasiveness is that the issues are not only very complex but also are more difficult to solve mainly because they affect political boundaries and emotional sensitivities. I don't know the extent to which good, thorough research on these major issues is possible in the present political milieu. If it is possible, I am certain of the importance

of recognizing the complexities in research design and of working in a mutually cooperative way within the established dental structures as much as possible. But if required, the need to use resources outside of dentistry must also be recognized. We tend in dentistry to be too reluctant to seek outside help. I guess what I'm saying is that for the really big educational manpower issues one must not just tinker in isolation with the odd bell or icicle but must study the decorated Christmas tree as a whole and, as needed, bring in the nondental elves and even Santa occasionally for help.

In closing, I've emphasized a few research ideas of particular relevance to dental hygiene because of the nature of this Conference. However, there is a danger in doing this as dental hygiene research should not be isolated from the whole dental care system of which hygiene is just one part. Nor should dental hygienist researcher limit themselves to their own area. The whole dental care system, including its educational component, needs good research by well-trained, objective and dedicated individuals and, especially multidisciplinary groups.

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CONTINUING EDUCATION IN DENTAL HYGIENE IN THE UNITED STATES: DIRECTIONS FOR EVALUATION AND RESEARCH

Denise O'Brien

Introduction

This paper presents a general overview of continuing dental hygiene education in the United States: the relation of continuing education to continuing competence; and a review of selected literature regarding dental hygienists' attitudes toward continuing education, types of continuing education preferred and evaluation research in dentistry and dental hygiene.

Continuing dental hygiene professional education is defined by the American Dental Hygienists' Association as...

> education of the individual beyond the basic preparation for the profession of Dental Hygiene. The primary goal is to promote optimal health services to the public by fostering continued professional competence. Continuing education includes educational activities that update, refresh and increase the knowledge and competency of the dental hygienist.[1]

Continuing education in dentistry began with the return of World War II dentists to civilian life in the late 1940s. Educational benefits were offered to veterans of military service for the purpose of formally updating their technical knowledge. The first requirement for continuing education in dentistry occurred in the early 1960s with the passage of the dental portion of Medicaid (Title XIX of The Social Security Act) in New York state. Dentists participating in the program were required to document attendance at a prescribed number of continuing education courses.[2] The momentum for mandatory continuing education grew through the late 60s and 70s. Dental hygienists were first required to obtain mandatory continuing education for licensure renewal in Minnesota in 1969.[3]

Status of Mandatory Continuing Education

As of August 1982, 12 state boards of dentistry require a prescribed number of continuing education units (CEU's) for dental hygiene licensure renewal. Eleven state boards of dentistry have similar requirements for dental licensure renewal.[4] Since the state's requirements developed state-by-state the decision for mandatory continuing education appears to have been reached independently by each state board. It is undetermined if the mandatory continuing education for dental hygienists was due to efforts of dental hygienists in the state. The pattern of mandatory continuing education is similar for dentists and dental hygienists in all but one state.[3] However, some dental hygiene societies require continuing education for membership in state associations.

Professional Involvement in Continuing Education

From 1973 to 1980, the American Dental Hygienists' Association administered a continuing education course approval and registry system. More than 2600 courses were reviewed and approved based on standards established by the Continuing Education Committee.[5] Both the course approval and registry system were discontinued in 1980 due to high administrative costs. The ADHA does award continuing education units for courses which are offered by ADHA. This includes a variety of self-study courses and scientific sessions presented in conjunction with the ADHA Annual Session and the American Dental Association Annual Meeting.[6]

Relation of Continuing Education in Dental Hygiene to Other Professions

The movement toward mandatory continuing education in dentistry and dental hygiene during the 60s and 70s was consistent with other professions although dentistry may have proceeded somewhat more slowly. In a review of the literature of health professions from 1960-1970, Nakamoto and Verner stated that:

> The nature and structure of dentistry as a profession coupled with the geographic distribution of its member has created problems that are barriers to the systematic development of continuing education in dentistry. Although these barriers are by no means insurmountable, they do account, in part, for the slow growth of continuing education in the profession.[7]

A review of mandatory continuing education for professionals illustrates a high level of professional support particularly for certified public accountants, nursing-home administrators, optometrists, physicians and veterinarians.[8]

Mandatory Continuing Education Debate

As dentistry became swept along on the tide of mandatory continuing education, strong dissension mounted within the profession. Despite 15 years of continued debate over the issue of mandatory continuing education in dentistry, the subject remains controversial.[9-12] With the escalating technological development of the 60s and 70s, structured continuing education was a method for assimilating new knowledge and skills. Opponents of mandatory continuing education raised questions about the productive use of this knowledge. The inability to convincingly link continuing education to improved patient care in dentistry exposed the complexity of the process of continuing competence. Critics asked: how do we know that the continuing education experience is what the individual needs to make him more competent? If mandatory continuing education is not as dependable as an exclusive method for assuring continued competence, what alternatives should be considered?[11]

With the development of peer review and computer assisted methods of quality assurance (chart audit and systems reviews) perhaps the focus on the continuing education of the practitioner has become a distinct parcel of overall quality assurance measures. Even so, continued learning remains as the predominant alternative for the individual practitioner to maintain competence in practice.[13]

Continuing Education and Continuing Competence in Dental Hygiene

What is the role of continuing education in relation to continuing competence in dental hygiene? The ADHA Commission for the Assurance of Competence investigated this question shortly after the formation of the Commission in 1979. By 1982, after an extensive study of competence assurance in other health professions, the Board of Commissioners developed a two-phase plan which was approved by the ADHA House of Delegates in June 1982.[14]

The first phase of the plan consists of a self-directed professional development guide that will assist the individual dental hygienist in assessing individual learning needs and identifying a variety of learning experiences to meet those needs. The emphasis is on self-directed learning and professional development. The second phase is designed to obtain congruence between the education, practice and credentialing of the dental hygienist based on role delineation.[14]

Dental Hygienist as Adult Learner

The continuing education of the practitioner in the self-directed professional development model is consistent with the concepts of the adult learner. Sponsors of continuing education in dental hygiene (institutions, dental hygiene societies) need to be informed and skilled practitioners in the principles of adult education.[5,15] Knox describes the adult learner in the following way:

> Adults learn most effectively when they proceed at their own pace. With age, adults become more cautious in learning tasks; because they have more experience and information they have to

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> engage in a wider search when trying to remember.... Effective adult learning is an active search for meaning. Adults seldom learn, remember and use answers for which they do not already have the question.[15]

The adult learner is self-directed, motivated by a desire for problem-solving and approaches satisfying his educational needs by information-seeking through a variety of channels. In this way, "continuing education" is not a list of teacher's objectives which are passively transmitted to students. The practitioner is the active seeker of information which meets his individual needs, goals and concerns. Other professionals have discussed dissatisfaction with the traditional content-structured approach in continuing education and have suggested process-oriented learning based on the motivation of the individual.[2,5,11,16]

Areas for Inquiry

Up to this point, we have reviewed the development of continuing education in dentistry and dental hygiene, briefly describing trends and current patterns. The move toward mandatory continuing education in the 60s and 70s appears dormant although states which adopted this approach have not changed direction. Can we predict a pattern for the 80s?

What do we know about the effects of the past 13 years of mandatory continuing education in dental hygiene? What percentage of dental hygienists participate in continuing education each year. What do we know about dental hygienists' continuing education attitudes and behavior? Do dental hygienists in states without mandatory continuing education participate as actively in continuing education as those hygienists in states with continuing education requirements for licensure renewal? Do dental hygienists living in states with mandatory continuing education perceive that this requirement contributes to their knowledge, skills, or patient care?

A recent study of the attitudes of Canadian dental hygienists indicated that the "average respondent was mildly in favor of mandatory continuing education".[17] Factor analysis suggested that those in favor felt that mandatory continuing education would "increase the prestige, competence and appreciation of dental hygiene as a profession."[17] Would this response be similar in areas which do or do not require continuing education? How do the expressed attitudes of dental hygienists relate to participation?

Research on the adult learner provides us with a theoretical basis for effective structuring of self-directed continuing education. However, information on the continuing education behaviors of dental hygienists is lacking. Are hygienists exhibiting self-directed learning behaviors in their professional development? With what frequency do practitioners read a variety of journals and participate in study clubs, society meetings or other non-formalized continuing education experiences?

In 1976, Malvitz and Judge[18] reported on participation in continuing education by dental hygienists. They concluded that:

> Hygienists holding advanced degrees were more likely to report they had participated in continuing education within the preceding year than those holding baccalaureate degrees, and the latter were more likely to have participated recently than those whose only degree was associate.[18]

Similarly, adult participation in continuing education in our society increases greatly with the educational level of the participant.[15] This indicates a relationship between information-seeking of the adult and the level of education. This behavior pattern suggests that perhaps some adults are more drawn toward learning based on positive past learning experiences.

This pattern raises questions of interest to both the dental hygiene educator and the provider of continuing education. Does basic dental hygiene education foster a stimulus toward professional life-long learning? Do educators induce students to be active information-seekers? In what ways can the initial dental hygiene experience contribute to the practitioner's commitment to learning and self-development?

Learning Needs and Preferences

What information is available to continuing education planners regarding dental hygienists educational needs and preferences for learning? Many surveys conducted by individual planners are similar in providing a checklist of subjects or topics for the respondent. For example, Keevil and Cartwright[19] surveyed dental hygienists in Michigan to determine preferences in continuing education experiences. The dental hygienists surveyed responded with general subject categories rather than specific topics. The subject identified most frequently was root planing and soft tissue curretage.[19] Perhaps there are some underlying problems in this area which could be further examined. A needs assessment based on specific difficulties or "problems" encountered in practice might lend new insights to the preferences of dental hygienists. Continuing education planners might focus efforts toward analysis of situational problems and away from the content-centered approach.

Recent social trends suggest a further differentiation in the educational needs of practising dental hygienists. With high costs and a tight economy, hygienists may be remaining in practice longer than in previous times.[20] This emerging practice pattern indicates that dental hygienists are increasingly likely candidates for professional obsolescence. Gaynor defines obsolescence as "the deterioration of acquired knowledge with the non-acquisition or non-utilization of new knowledge" and states that, "a professional's knowledge may be out of date only five years after completion of training."[2] This concept appears to be well acknowledged by most professionals and society as a whole.[15,16]

Another social trend is the re-entry into the workforce of the dental hygienist who has been unemployed for a number of years.[5] Both the professional practising for a greater number of years and the re-entering professional might be expected to exhibit differing continuing educational needs from the recent graduate. What types of learning experiences would be most beneficial for the professional and social needs of these emerging groups? Are continuing education experiences currently being provided meeting these needs?

Methods of Evaluation

Continuing Education Units. The quality of continuing education and the extent to which continuing education experiences meet the needs of participants should be basic required areas for evaluation. Unfortunately, providers of dental hygiene continuing education are not required to evaluate courses in any specific way. States mandating continuing education for dental hygienists measure the learning experiences in terms of the number of Continuing Education Units (CEU's) earned. CEU's are based on the number of hours spent in learning activities and are the most prevalent measure of continuing education in the professions.[16] Both the American Dental Association and American Dental Hygienists' Association participate in awarding CEU's based on clock hours. This system has not been legitimized in health professions in general because the CEU designation "bears no assurance that desired changes in competence or performance of participants have occurred."[16] Further, in dental hygiene in the United States, virtually any organization may "confer" CEU's on participants. Ultimately the only challenge to the CEU in dental hygiene is in those states which evaluate the continuing education course itself when requiring CEU's for licensure renewal. Additionally, the use of CEU's for evaluating continuing education restricts the continuing education experiences to more formal and traditional approaches. The lecture/seminar is the most common method of continuing education in dental hygiene. Since this method necessitates travel, it can place a burden on the practitioner who lives in a remote area or who is financially limited.

Participant Course Evaluation. The next most common method of evaluation in continuing education is the participant's assessment of the course. This is usually obtained through a brief questionnaire which the participant completes at the conclusion of the course. This measure can be helpful in assisting program planners in presenting appealing courses; however, this measure as a sole criterion of quality has been substantially discounted.[16] A now classic series of investigations on the perceived quality of instruction were conducted in the medical profession in the early 1970s. An actor, given a professional title and curriculum vitae, delivered a lecture to an audience of professionals and graduate students. The presentation consisted of "double talk... contradictory statements... and meaningless references."[21] During the

presentation however, the actor exhibited a charismatic style full of personal warmth and appeal. Subsequent participant evaluations judged the presentation exceedingly positive in all areas despite the overall lack of meaning of the lecture. This has been referred to as the "Dr. Fox effect" in continuing education literature.[13,16,22] While this study illustrates the benefits of charisma, it also indicates that participant evaluation may not always be reflective of the content quality of a course.

Exams. Another method which is less frequently used in voluntary continuing education programs is the exam or pre-and post-tests. A 1974 survey of dentists in New York revealed that only 15 per cent felt that "successful completion of examinations in (mandatory continuing education) courses should be a prerequisite" to licensure renewal.[12] Perhaps a reticence on the part of practitioners toward exams has influenced providers toward other measures of participant evaluation.

Various dental and dental hygiene continuing education providers have used the pre-and post-test method to determine the effect of the continuing education course on the participants' mastery of knowledge and/or skills.[13,22,23] This approach has been effective in courses which are competency-based with predefined objectives and levels of learning. While this method is limited in that it cannot evaluate if the acquired knowledge and skills are used in practice, it does provide an objective evaluation of learning beyond the participant's perception. This is suggested in a recent study of 33 Minnesota dental hygienists who participated in a 30-hour continuing education course in root planing and soft tissue curretage. Young *et al* reported that the dental hygienists demonstrated a significant gain in knowledge at the conclusion of the course as measured by multiple-choice pre-and post-tests.[23] Six months after completion of the course, students rated the effectiveness of the course. No relationship was found between the student's rating of the effectiveness of the course and the knowledge gain as determined by pre-and post-test scores.[23] This finding is similar to the "Dr. Fox effect" in that participants may judge the effectiveness of a course on a variety of extraneous variables. In summary, the pre-and post-test may provide a measure of acquired knowledge and skill if the honesty of the participant can be assumed on the pre-test. However, this measure cannot be assumed to relate to an improvement in patient care.[22]

Measures of Participant Behavior. Measures of practitioner behavior which have been used in dentistry and dental hygiene include self-report, behavioral observation, patient clinical examination, and records review.

Chambers[22] investigated the relationship of self-report and objective behavioral observation in a study of the effectiveness of a course on four-handed sit-down dentistry on the subsequent behavior of practising dentists. Observers rated the overall dentist's performance in the office based on an objective criteria scale. Dentists who had participated in the course also reported the changes that they had made based on the information received in the course. The objective ratings of performance by the observers did not agree with the dentists self-report of behavioral change resulting from the continuing education session.[22] Interestingly, the dentists had adapted and modified aspects of what had been taught to fit their perceived needs and constraints.

As the previous studies imply, practitioners may judge a course as effective and gain additional knowledge yet resist changes in practice patterns or perceive the changes inaccurately. Young[23] used self-reports prior to a continuing education course and six months after to evaluate long-term effectiveness. Student's self-ratings of performance increased significantly on areas of root planing, soft tissue curretage and probing. However, an analysis of pre and post-course instrument selection revealed no significant differences. In fact, "a large proportion of the students preferred an instrument different from the one that was taught in the course and considered inappropriate for the intended use."[23] Further information on the reasons for the students inappropriate instrument selection would be of interest. As in the Chambers[22] study there appears to be a discrepancy in what was intended to be "learned" and the resultant participant behavior.

Other studies have indicated a positive relationship between continuing education and practitioner performance. Weinstein[24] *et al* correlated dentists' perceptions of the usefulness of continuing education with the quality of patient care. Nine hundred and eighty-six patients of 65 general practitioners were examined and rated on quality of operative dentistry and oral health status. The dentists were surveyed to determine their perceptions of the usefulness of a variety of continuing education experiences. Of those experiences, a positive correlation was found between the practitioner's perceived usefulness of university courses, study clubs and talking shop and higher technical measures in dental care.[24]

Sutton and Lysaught[25] investigated long-term effects toward improved patient care as a result of a six-week practicum for dental hygienists. Self-reports conducted one year after the course indicated that all participants had applied knowledge and skills from the course and that the use of curets and periodontal probles had increased with the participants' increased skills and confidence.[25] Those participants who had discussed their educational experience with their employers reported more expanded roles and a desire for more continuing education experiences.

This literature review suggests questions for further investigation. To what extent are the various measures of the effectiveness of continuing education reliable? How might the CEU be a more accurate evaluation of continuing education experiences? Do practising dental hygienists desire a more qualitative evaluation of continuing dental hygiene education? Can methods of self-report determine long-term effects of practitioner behavior? What is the nature of the "conflict" between teacher expectations and subsequent practitioner performance and perceptions? Under what circumstances is it possible to relate a single continuing education activity to practitioner behavior or patient outcomes? How might the employment environment of the dental hygienist affect the practical application of continuing education experiences? Might attitudes toward learning be related to the quality of patient care?

Evaluation of continuing education has demostrated an interesting, if not perplexing mix of information. The methods of evaluation discussed illustrate progressive attempts to verify the effectiveness of specific education approaches.

This review of continuing education in dental hygiene in the United States may serve as a fundamental base or "trigger" for the dental hygienist interested in providing continuing education or conducting research in this field. This paper suggests diversified areas of inquiry which draw upon current concepts of adult and continued professional learning. The author strongly encourages a thorough investigation of the literature in other fields. To quote Cyril Houle:

> To know but one profession is not to know that one, and to work wholly in terms of its specific dictates is to adopt a limited framework for thought and action.[16]

Research and evaluation in continuing education need to be both specific and broad. Much information is needed regarding dental hygienists' unique characteristics with regard to attitudes, needs, preferences and behaviors. At the same time, dental hygienists who pursue the study of continued learning and adult education principles will find a vast number of resources which can enlarge the creative exploration of dental hygiene continuing education of the future.

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FLUORIDE RESEARCH: THE POTENTIAL OPPORTUNITY FOR DENTAL HYGIENISTS

Alice M. Horowitz

Dental research findings have resulted in significant improvements in oral health, and we anticipate that they will contribute even more in the future.[1] Although dental hygienists have been a part of the dental team since the 1920s, they have not traditionally concerned themselves with research.[2] However, because dental hygiene has always focused on preventive aspects of oral health care, it is logical for hygienists, with appropriate training, to become involved in research to prevent oral diseases and, ultimately, to advance the oral health of the public.

I will limit my presentation to my assigned topic — research on fluorides — and will address the potential role for dental hygienists in this work. Two assumptions are basic to this discussion: first, that dental hygienists are capable of scholarly research and, second, that they have a responsibility to patients, their community, and the dental profession as a whole, to play a strong role in fluoride research for caries prevention.

The findings of (classical) studies in the 1930s, 40s, and 50s of the relation between concentration of fluoride in drinking water and tooth decay are well known. The value of community water fluoridation has been examined internationally with uniformly impressive results. No other health measure has been subjected to more critical analysis than water fluoridation. The entire community benefits from the procedure, regardless of age, socioeconomic level, educational attainment, individual motivation, or the availability of dental personnel.[3–6] Although the benefits of fluoridation are impressive, it is not a panacea for preventing tooth decay, because it does not provide total protection, and its use is limited to areas with central water supplies. Thus, additional fluoride procedures are necessary for particularly susceptible persons living in fluoridated communities, and other ways to apply fluoride must be practised by those who live in fluoride-deficient areas. Decades of research have shown that dietary fluoride supplements for children whose water supply is fluoride deficient can confer benefits that approximate those of communal water fluoridation. Furthermore, nearly 30 years of research have clearly demonstrated that fluorides can be effective when applied to erupted teeth and that some methods of topical fluoride application supplement the benefits of systemic fluorides introduced during tooth formation. Hundreds of studies done in many countries have shown that operator-applied fluorides and self-applied fluorides will reduce dental caries.[5,7] This vast accumulation of research, and the wide variety of fluorides available — especially in developed countries — might cause one to question the need for additional fluoride research. Such a notion is reinforced by recent evidence from developed countries showing that dental caries in school children has declined.[8–10] Although we cannot show definitively why the decrease has occurred, it is likely that the more widespread use of fluorides — community and school water fluoridation, fluoride-containing dentifrices, school-based self-applied fluoride tablet and rinse procedures, and perhaps greater use of operator-applied fluorides — have had a significant effect. While this achievement is both rewarding and exciting, it should be viewed as an excellent beginning and not as an end to the war against caries. First of all, these results have been demonstrated only in children; yet, tooth decay attacks all ages, as long as natural teeth remain in the mouth. Second, if we do not continue doing whatever is contributing to the decrease in dental caries, an upswing can be expected. In fact, that is exactly the case in Austria, where for over a decade fluoride tablets have been distributed to children in school. In recent years, however, teachers have been less cooperative in this effort, and, as a result, one investigator claims that caries rates in Austrian children are climbing.[11] Last of all, while a 30 to 40 per cent reduction in the prevalence of dental caries is admirable, we should not be satisfied until the disease is eliminated.

Today, the appropriate use of fluorides is the most effective measure available to prevent tooth decay. Because this disease remains a major public health problem, additional fluoride research is needed at all levels — laboratory, clinical, and technology transfer — that is, the application of research results. This paper will be limited to the two latter aspects, because while hygienists would need more training to become involved in controlled clinical trials and in technology transfer research than that generally provided at the bachelor and master degree levels, it would be substantially less than that required to conduct laboratory research. In addition, because most Canadian residents do not have optimally fluoridated water and because there is a lack of clinical dental investigators in Canada, developing the research potential of hygienists appears to be particularly useful.[12,13] Moreover, research on the best ways to disseminate information on the appropriate use of fluorides is greatly needed. Fluorides used in conjunction with fissure sealants can virtually eliminate dental caries, yet, neither procedure is used maximally, and much of the public remains ignorant about them.[14] Today, the need is worldwide for an extensive effort to determine methods of using or applying the knowledge gained from laboratory and clinical studies.

Clinical Research Needs

In 1977, Dr. Herschel Horowitz recommended 18 areas of possible research for clinical investigators of fluorides (see Table 1).[15] Several of these recommendations deserve further discussion to update findings from studies begun since 1977 and to reemphasize the need for a few of these recommendations. The last of the studies recommended concerned adult caries and deserves special attention. The recommendation reads: "Additional studies are needed on the effects of topical fluorides on primary teeth and in adults, the latter, particularly with respect to root caries."[15] Of the hundreds of fluoride studies done, relatively few have been on adults, and fewer on the elderly. While this situation is easily explained, it does not erase the need, especially in developed countries, where more adults are retaining more natural teeth than ever before, and the elderly are fast becoming an increased proportion of the population. Thus, studies are still needed to determine the efficacy of various self-applied and operator-applied fluorides among a broad age-range of adults.

Studies suggested in item 5 on the list are needed to determine the duration of benefits after application of preventive agents for short periods of time, as currently evaluated in most studies and, likewise, follow-up studies (item 10) of children who have received systemic fluorides, e.g., dietary fluoride supplements or school fluoridation for a number of years to determine benefits retained after systemic exposure ceases. This research is difficult to accomplish but greatly needed. We need to know whether we are preventing decay or just delaying it. Further, we need to know what subsequent uses of fluorides will perpetuate the benefits of procedures used during childhood. Because evaluations of some of these methods of application have taken place in Canada, populations are potentially available for study.

Since 1977, several studies concerning item 14, to determine the importance of tooth cleaning before application of both concentrated and dilute fluoride agents, have been completed or begun. Although findings have not yet been published, at least two studies have been completed on tooth cleaning prior to an operator-applied fluoride. To my knowledge, however, there has been only one study concerning the effect of prior tooth cleaning by toothbrushing and/or flossing on the effectiveness of fluoride mouthrinses.[16] Additional studies need to be

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done to corroborate or refute earlier findings. This information is particularly needed if self-applied fluorides are to be broadly used.

Another of Horowitz' recommendations, item 11, requires additional comments. He suggested that studies combining administration of fluorides by two or more methods, particularly combinations that are likely to produce benefits by different mechanisms of action should be conducted. Accumulating evidence does in fact show additive caries protection from certain combinations of fluoride procedures.[4] For example, the National Institute of Dental Research (NIDR) is studying children in a rural county who consume a 1 mg. fluoride tablet daily in school, rinse weekly in school with 0.2 per cent sodium fluoride solution, and use a fluoride toothpaste *ad libitum* at home. The findings of the combined fluoride regimen are dramatic and suggest that the benefits may be greater than those reported for any of the individual components. But, at present, no specific claims of additive effects can be made because particular components of the total regimen have not been evaluated.[17] Thus, NIDR has begun a new study to compare the effects of fluoride tablets and mouthrinsing when used alone and in combination. If findings of the combined use of both procedures are not significantly different from either procedure used alone, savings in time, cost, and personnel can be achieved by employing just one of the fluoride agents. A replicate study is needed. Such information will be particularly valuable for a country such as Canada in which large numbers of the population cannot benefit from community water fluoridation.

Other clinical studies that would provide us with useful information are those that determine the importance of abstaining from eating or drinking for 30 minutes following either operator-applied or self-applied fluorides. Each of you who has applied topical fluorides or supervised the use of self-applied fluorides will recognize the *caveat*, "don't eat or drink for 30 minutes." There is no scientific evidence to support this recommendation, no matter how logical it sounds. Although this research is not pressing, it would help us to know whether to continue the admonition. The implications are especially important for school-based regimens where the need to schedule treatments that avoid lunch or snack time can be a deterrent to acceptance of the procedure.

Research in Acceptance and Use of Fluorides

If none of these suggestions for clinical studies particularly interests you, you might consider other aspects of fluoride research.[18] The need to increase the acceptance and utilization of fluorides probably outweighs the need for clinical information at this time. The opportunities are extensive, and unless a strong focus on acceptance and proper use of fluorides (and other caries preventive measures) is begun, much of what is known cannot be transferred into use by either health professionals or the public.

For example, studies need to be conducted in Canada to determine what health professionals (including dentists, dental hygienists, physicians, nurses, and pharmacists, in both the private and public sector) know about the appropriate uses of fluorides, what they advocate for their patients, and what they use either in their practices or communities. We do not even know the best ways to gain professional acceptance and use of caries-preventive procedures. Further, surveys should be undertaken to determine *what* educators believe they are teaching dental and dental hygiene students regarding the appropriate use of fluorides. Moreover, surveys should be conducted of all age groups of the general population to determine what they know about fluorides.

Another area that is ripe for exploring is what school teachers know and teach about the best way to prevent dental caries. Do they provide information on fluorides? If so, is the information they provide current and scientifically sound? Also needed is a survey of the educational aids available in Canada for teaching health professionals and the public about fluorides. These kinds of surveys would help determine research needs on acceptance and use of fluorides. Also, it would be interesting to know who participates in school studies and why or why not.

Because fluoride tablets are used extensively in some of the provinces, compliance of families in using the tablets for the necessary length of time would be another particularly valuable area of research. Similarly, compliance studies are needed on school-based fluoride programs.

In addition to the few topics I have suggested, dozens of other researchable ideas can be generated from a continuing, thorough review of the literature. There is no substitute for the intimate knowledge obtained from scientific literature. The researchable ideas available from these sources will strongly challenge a creative mind. In addition, it is important to become acquainted with respected researchers in the area that interests you. This meeting is an unparalleled opportunity to do so. May I suggest that you consider joining the International Association for Dental Research and attending their annual sessions to help facilitate your entry into dental research.

Although I suspect others will address the need for additional training before hygienists assume various roles in research, I should mention a few points. For example, the variety of personnel involved in clinical research include, but are not limited to:

- Principal investigator — who is responsible for the overall design and conduct of the study;
- Statistician — who helps design the study, particularly with regard to sample size and analysis of data;
- Clinical investigator — who applies the appropriate index of measurement; and
- Field coordinator — who ensures that the study is being carried out according to the protocol.

With appropriate training, either formal or on-the-job, and experience, dental hygienists could perform any of these functions and the latter two could probably be accomplished with minimal training. Similarly, if you wish to do research on diffusion of information about fluorides and adoption of fluorides, you will need additional training. In either area, much remains to be done, and the opportunity for educated, motivated dental hygienists in research will be as broad and as varied as you make it. It should be clear that although my presentation is limited to the topic assigned to me — research on fluorides — dental hygienists have the opportunity for becoming involved in other kinds of clinical research, as well. The important step is to decide what you are most interested in, get the appropriate training, and go do it!

TABLE 1. Recommendations for clinical studies proposed by H.S. Horowitz in 1977.

1. Epidemiological investigations of the effect of community fluoridation and of various topically applied agents in populations with grossly different susceptibilities to dental caries.
2. Determination of optimal concentrations for community fluoridation among populations with highly different diets, particularly with regard to fluoride content.
3. Definitive surveys to determine the relative susceptibility of teeth with moderate and severe forms of fluorosis to dental caries.
4. Studies to refine the dosages of dietary fluoride supplementation for maximal caries protection in relation to age and body weight.
5. Studies to determine the retained benefits or duration of effects following the application of preventive agents for 1, 2, or 3 years, as currently evaluated in most studies.
6. Studies to elucidate the most effective agents, concentrations, and frequencies of application for mouthrinsing programs with dilute fluoride solutions, as well as other methods of topically applied fluorides. Mouthrinsing programs are pinpointed in this recommendation because of their economic and procedural advantages compared with most other methods.
7. Developmental and evaluatory studies of materials such as varnishes and temporary sealants designed to prolong contact between fluoride and enamel in order to enhance permanent incorporation of fluoride.
8. More studies of agents that have given preliminary encouraging results, e.g., amine fluorides, ammonium fluorides and titanium tetrafluoride.
9. Clarification of the efficacy of various topically applied fluorides among children born and reared in a fluoridated community.

10. Follow-up studies of children who have had fairly lengthy periods of exposure to systemic fluorides, e.g., dietary fluoride supplements or school fluoridation, to determine retained benefits after systemic exposure ceases.
11. Combining administration of fluorides by two or more methods, particularly combinations that are likely to produce benefits by different mechanisms of action.
12. Studies to elucidate the clinical effectiveness produced solely by topical exposure to fluoridated water.
13. Analysis of data from clinical studies of fluoride to determine effectiveness according to initial caries prevalence of subjects or, better still, measures of current caries susceptibility (active lesions?).
14. Determination of the importance of tooth cleaning prior to the application of both concentrated and dilute fluoride agents given at various frequencies.
15. Additional studies of fluoride uptake by enamel from various fluoride agents and procedures and its relation, if any, to caries protection.
16. Further studies on school fluoridation to determine optimal concentrations in various climatic zones and whether it is necessary to fluoride both elementary and secondary schools to achieve maximal benefits or if comparable protection is produced by fluoridating only elementary schools.
17. Studies of pretreatment of teeth, e.g., with acid or aluminum salts, in order to enhance the benefits of subsequent fluoride applications.
18. Additional studies on the effects of topical fluorides on primary teeth and in acults, the latter, particularly with respect to root caries.

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PRENATAL FLUORIDES AND DENTAL CARIES — A CASE STUDY ON INTERPRETING DATA

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When Professor Forgay first invited me to participate in this conference she asked whether I might be willing to give a presentation on a topic within preventive dentistry that would be of interest to dental hygienists and that would also serve to illustrate a more or less important issue relevant to the conduct of research. After considering a number of possible topics, I have focused on one that I think is particularly important to any beginning researcher. Essentially, I believe that one's ability to identify, within a specified subject area, a research question worth investigating is partly dependent on one's talent in reviewing the available literature in a scientifically critical manner. In this way questionable study design, inconsistencies in data, omissions in analysis and useful additional research directions can be identified and acted upon. A similar critical attitude, when applied to one's own research, may further serve to enhance the quality of the scientific work accomplished by the investigator in question.

To this end, I would like to examine with you some of the published research on just one narrow topic, namely, prenatal fluoride supplements. In a general sense, let us find out what the current thinking is with respect to the role prenatal fluoride supplements should play in preventive dentistry. More formally, let us ask the question whether, in a nonfluoridated area, there exists theoretical and empirical evidence to justify prescription of prenatal fluorides prior to the widely accepted procedure of postnatal fluoride supplementation.

In evaluating how to address this question, it is helpful to place some perspective on just what sort of research design would provide some reasonable answers. Accordingly, an estimate of the marginal effectiveness of prenatal fluorides used in conjunction with postnatal fluorides requires either a natural or a planned experiment which includes, at a minimum, children exposed to pre- and postnatal fluoride on the one hand and children exposed to postnatal fluoride only on the other. Studies which fulfil these minimal design criteria are ones I would like to examine in the remarks to follow.

Perhaps the most surprising aspect about current published literature on prenatal fluoride effects is the manner in which the dental caries data have been analyzed or reviewed by others. Considering that studies applicable to determining the effect of prenatal fluoride exposure on caries are few and often imperfectly designed, it appears too little effort has been made to carefully examine the available data from the maximum information. As a result, some misunderstandings are created as to the potential effects of prenatal fluoride exposure on caries.

TABLE 1. EVIDENCE CITED FOR CARIES-PREVENTIVE EFFECTS OF PRE- AND POSTNATAL EXPOSURE TO FLUORIDATED WATER

	Study supports the concept of pre- in addition to postnatal fluoride		
Study by:	**Thylstrup**	**Driscoll**	**Glenn**
Blayney & Hill[4]	—	Yes	Yes
Tank & Storvik[5]	—	Yes	Yes
Carlos, *et al*[6]	No	No	No
Horowitz & Heifetz[7]	No	No	Yes
Katz & Muhler[8]	No	No	No
Lemke, *et al*[9]	—	No	No
Lewis, *et al*[10]	—	No	No

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For example, Table 1 summarizes how three well-known authors, Drs. A. Thylstrup,[1] W. Driscoll[2] and F. Glenn[3] have marshalled the available evidence from water fluoridation studies[4–10] concerning the possible benefits of combined pre- and postnatal fluoride exposure as against postnatal exposure only.

To be noted in the table are the various interpretations placed on a given tabulated result. First, one might note that Professor Thylstrup omits to cite the two studies for which the empirical results are inconsistent with his own thesis on biological mechanisms involving fluoride. A second feature of this table is that Drs. Driscoll and Glenn have used one study to support opposite claims. To satisfy ourselves as to an appropriate interpretation of this latter study, Table 2 shows the results in question as originally published by Horowitz and Heifetz.[7]

TABLE 2. CARIES EXPERIENCE IN 2509 7-YEAR-OLD MINNEAPOLIS CHILDREN AS A FUNCTION OF BIRTH RELATIVE TO FLUORIDATION[a,b]

Group	N	Prenatal Fluoride Exposure (Months)	Caries Experience	
			defs	DMFS
A	509	0	6.35	0.81
B	426	<3	6.70	0.79
C	473	3-6	6.20	0.98
D	568	6-9	5.72	0.64
E	533	>9	6.02	0.68

[a] All children exposed to fluoridation postnatally.
[b] Table adapted from Horowitz and Heifetz, 1967.[7]

Looking at these data might persuade us that while children with more than six months of prenatal fluoride exposure demonstrate slightly lower observed defs and DMFS scores, the differences compared to the other caries scores appear to be sufficiently small in this study so as to cast doubt on the practical significance of prenatal fluoride exposure.

It is frequently believed that the well-known Katz and Muhler[8] data also do not support the use of prenatal in addition to postnatal fluoride. Such an interpretation of the Katz and Muhler findings should be challenged. Table 3 shows the data in question which are organized to compare defs and DMFS scores in similarly-aged children, one group being exposed to fluoridated water pre- and postnatally while the other experienced postnatal exposure only.

TABLE 3. DENTAL CARIES EXPERIENCE IN CHILDREN IN W. LAFAYETTE, IND. AS A FUNCTION OF THEIR BIRTH RELATIVE TO FLUORIDATION[a]

Mean Age of Children (Yrs.)	Mean defs Per Child		Per Cent Difference[b]
	Prenatal and Postnatal F Exposure	Postnatal F Exposure Only	
4½	1.7	1.2	+41.7
5½	2.3	4.3	−46.5
6½	6.4	2.9	+120.69
7¼	4.1	6.1	−32.8
7¼	0.5DMFS	1.6DMFS	−68.8

[a] Adapted from Katz and Muhler, 1968.[8]
[b] Relative to caries under postnatal exposure.

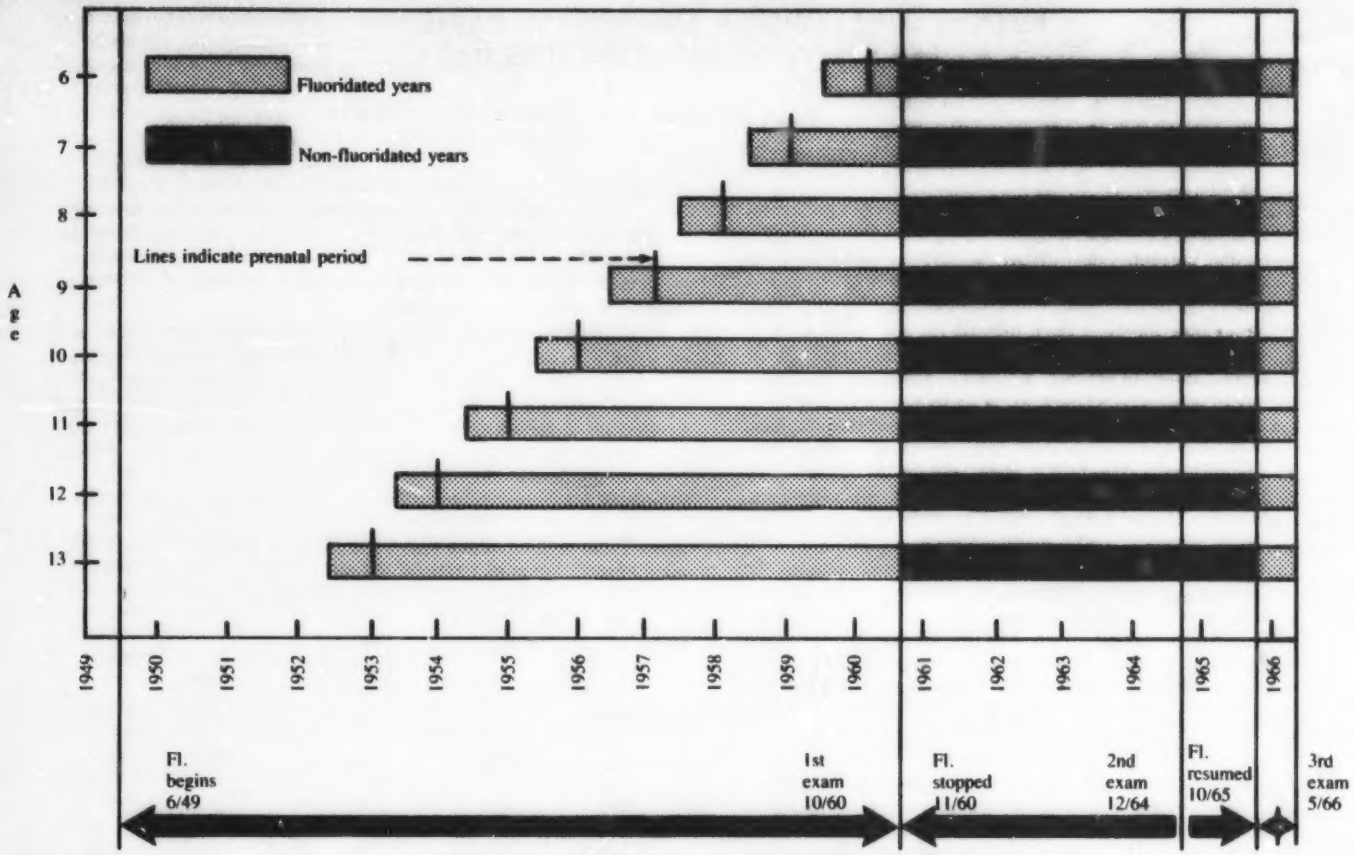

FIGURE 1. HISTORY OF FLUORIDE EXPOSURE OF CHILDREN AGE 6 THROUGH 13 FROM 1950 TO 1966 IN ANTIGO, WISCONSIN. LEMKE *et al*[9]

When the differences in the caries levels are calculated relative to the postnatal exposure group, one observes remarkable swings in the percentage reduction figures. The source for oscillation between positive and negative differences seems to be tied to internal inconsistency in the data. Note that in both groups there is a very disorderly progression of dental caries with age. For example, in the pre- and postnatal group there is a dramatic and most unlikely decline in the defs between 6 and 7 years of age. Similarly in the postnatal group the swings in the defs are even more illogical. Examination of the results from any major North American dental survey shows that mean primary tooth caries rates increase monotonically with age over the period covered by the Katz and Muhler data.[11,12] Under such circumstances, this study ought not to be relied upon at all or it, if anything, supports the notion that there is an additional caries-preventive effect ascribable to prenatal exposure to water fluoridation.

Let us now turn to a study by Lemke *et al*[9] on the caries effects from the discontinuation of water fluoridation in Antigo, Wisconsin. Again, this article is occasionally cited to provide evidence that exposure to pre- and postnatal fluoridation does not confer a greater caries-preventive effect than does postnatal fluoride exposure alone. Figure 1 is the schematic history of fluoride exposure as shown in the Lemke[9] article. The feature to notice is that while all groups of children examined experienced prenatal exposure to fluoride, it is only in the length of their postnatal fluoride exposure that they differed. Consequently, the most germane interpretation of the age-specific caries changes observed by Lemke *et al*[9] between 1960 and 1964 is that reduced postnatal exposure to water fluoridation will result in higher caries rates. The Antigo study was not designed as an experiment to determine the marginal effect of prenatal fluoride exposure when combined with postnatal exposure. Hence, and similar to the Katz and Muhler study, the Antigo data are not particularly helpful in answering the main question about prenatal fluoride effectiveness.

The last study in Table 1 was that by Lewis *et al*[10] which related the restorative requirements of 5½-year-old children with varying exposures to water fluoridation in North York, a large suburb of Toronto. Again both Driscoll[2] and Glenn[3] concurred that no marginal caries-preventive effect could be ascribed to prenatal exposure to fluoridation. Table 4 is adapted from Lewis *et al*[10] and shows the amalgam restorations required by six groups of children where the negative numbers in column 3 indicate the existence of prenatal fluoride exposure. Thus groups E and F were exposed to prenatal fluorides for a full term, group D children were exposed to fluorides for only the last 4 months of fetal life, and group C children represent the best approximation to a cohort which experienced full postnatal exposure to fluoridation. Note first of all that group D, with only 4 months of prenatal fluoride exposure, had a similar caries experience to group C. But if one compares the total filling requirements of groups E and F with Group C, one obtains 17 and 33 per cent reductions respectively. More significantly, when one compares the need for compound restorations of group E and F with group C, one observes 31 and 43 per cent reductions respectively. Although the possibility exists, in this as in most of the other studies, that examiner effects may have played a role, it is difficult to accept the Lewis *et al*[10] study as offering no supportive evidence for a marginal caries-preventive effect due to prenatal exposure to fluoridation.

TABLE 4. MEAN RESTORATIVE TREATMENT REQUIREMENTS IN 5½-YEAR-OLD NORTH YORK, ONT. SCHOOL CHILDREN AS A FUNCTION OF BIRTH RELATIVE TO FLUORIDATION[a]

Group	N	Age At Start of Fluoridation (Months)	Number of Amalgam Restorations		
			Total	1-Surface	Compound Surface
A	249	15	3.47	0.73	2.73
B	115	9	2.62	0.71	1.89
C	284	3	1.80	0.72	1.06
D	378	–4	1.75	0.72	1.03
E	304	–12	1.59	0.75	0.73
F	411	–22	1.20	0.59	0.60
Total	1742				

[a] Adapted from Lewis, *et al*, 1972.[10]

In light of these remarks, it is useful to reexamine the more direct evidence of the caries-preventive experience with prenatal fluoride supplements. Table 5 shows the most significant reports as reviewed by Thylstrup,[1] Driscoll,[2] and Glenn[3].

TABLE 5. EVIDENCE CITED FOR CARIES-PREVENTIVE EFFECTS OF PRE- AND POSTNATAL FLUORIDE SUPPLEMENTS

Study by:	Study supports the concept of pre- in addition to postnatal fluoride		
	Thylstrup	Driscoll	Glenn
Feltman & Kosel[13]	—	Yes?	Yes
Hoskova[14]	—	Yes?	Yes
Kailis, *et al*[15]	—	Yes?	Yes
Prichard[16]	—	Yes?	Yes
Schützmannsky[17]	—	Yes?	Yes

? refers to the fact that while the reported caries reduction was positive there were one or more design flaws with the experiment.

In terms of data interpretation, one might note again that Thylstrup[1] omitted any reference to the prenatal fluoride supplement studies shown. A second point to observe is that both Driscoll[2] and Glenn[3] concur that the results, as reported, support the notion that administering pre- and postnatal fluoride supplements may have a greater caries-preventive effect on the deciduous dentition than postnatal supplements alone. Of the five studies, the one by Schützmannsky[17] is illustrative and her results are shown in Table 6.

TABLE 6. CARIES EXPERIENCE IN 6- AND 9-YEAR-OLD CHILDREN FROM HALLE, D.D.R. IN RELATION TO FLUORIDE SUPPLEMENT REGIMENS

Fluoride Supplements	N	Mean DMFT Score		Mean DMFT
		6-yr.-olds	9-yr.-olds	9-yr.-olds
None	100	4.22	7.94	2.78
Prenatal	100	3.54	6.88	2.61
Pre- and Postnatal	100	3.02	5.58	1.59
Postnatal	100	3.60	6.83	1.69

Adapted from Schützmannsky.[17]

Notice that among 6-year-olds the pre- and postnatal group demonstrates the lowest deciduous caries experience, this result also holding at 9 years of age. Comparing only the pre- and postnatal group against the postnatal group, the deciduous caries reduction favours the former by 16 and 18 per cent among 6 and 9-year-olds respectively. As for the permanent dentition among the 9-year-olds, pre- and postnatal fluorides appear to offer no additional benefit over that conferred by the postnatal tablet regimen alone.

Overall then, our knowledge of the caries-preventive effects of combined pre- and postnatal fluoride, according to current information available, appears to be based on data that have at times been interpreted in quite contradictory fashions. As I have tried to indicate, we can overcome part of this confusion by simply looking at the original data more carefully. Moreover, and if one can ignore for today the question of statistically significant versus clinically significant differences, then it is probably good science to say that in respect to the deciduous dentition the hypothesis of a marginal caries preventive effect ascribable to prenatal fluoride when combined with postnatal fluoride supplementation cannot be ruled out at this time. However, I would also want to caution you that the data are old. This implies higher caries rates and it may be that similar investigations undertaken now would not show similar results.

Summary

This concludes my brief presentation. I have suggested that an important element in gaining a research perspective on a particular topic is to develop an ability for critically examining the relevant publications. Within the framework of preventive dentistry, I illustrated this concept by examining the subject of prenatal fluoride supplementation. This exercise revealed that it is generally possible to improve one's grasp of the topic by a careful and critical study of the original data as presented in publications. In concluding these remarks, I hope to have persuaded you that an important first step in thinking about a new research project is to spend the necessary time and effort to scrutinize and properly interpret the existing data on the relevant subject. This is a skill that can be learned to a degree and normally, a period of graduate education is the best time during which to acquire it.

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OBTAINING A RESEARCH GRANT

Colin Dawes

Introduction

To carry out research, it is usually necessary to obtain some financial support in order to bring the project to a successful conclusion. There are a multitude of agencies which award research grants and all have different detailed application procedures. However, there are certain requirements to be met which are probably common to all. In this paper I will discuss some of these requirements from the standpoint of a new faculty member in a School of Dental Hygiene attempting to obtain a first research grant.

The first point I would make is that research in many areas has become relatively expensive and that there is great competition for the research dollar. Hence research in an academic career demands a considerable investment of time and energy, not only to carry out research projects but simply to keep up with the literature. It is becoming more and more difficult to carry out research on a part-time basis.

Training for Research

Unfortunately, many faculty members in dental hygiene have professional training to the level of a diploma only. While this may be sufficient to enable the faculty member to act as a collaborator or assistant in research projects, it will rarely be considered an adequate background for independent studies. At the very minimum, research training at the master's level will be necessary.

Thus the faculty member who hopes to conduct independent research will first need to complete the requirements for a bachelor's degree and then take research training for probably another two years to obtain the master's degree.

Most scientists now consider the required research training for independent investigation to include study to the PhD level, followed by one or two years of postdoctoral training. This may be unrealistic for a faculty member in dental hygiene at the present time but in an increasingly competitive environment for research, a good training is essential. Even if the dental hygienist is not in a strictly basic sciences area, he/she will still be competing for research grants with PhD's in sociology, epidemiology, health care economics and other disciplines.

Before beginning training at the graduate level, the dental hygienist will presumably have selected an area of research interest. The most crucial decision to be made is the selection of a research supervisor. The average student usually makes the erroneous assumption that the local faculty member interested in the same research area is the most suitable person. This assumption is most likely not true. If the hygienist is really serious about research, then the literature should be surveyed and an attempt made to study with the best researcher in the field who will probably be located at another university. Graduate study with a mediocre researcher guarantees inadequate training. Thus the student should inquire closely into the publication record and grant-obtaining ability of a potential supervisor.

Selecting a Funding Agency

Before a suitable granting agency can be approached, the nature of the proposed project must be defined in some detail. A new applicant would be wise to select initially a project of modest scope that can be completed within one or at most two years. A common failing of new applicants is that they either select a project which would realistically take many years to complete or which is exceedingly broad in scope because every conceivable aspect of the problem is to be studied. Granting agencies usually prefer to support well-focused projects and, initially, rarely for more than one or two years.

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The nature of the project will define the required budget which will be a major factor in determining the type of granting agency to be approached. Most universities now have an office of research administration from which advice can be obtained regarding potential funding agencies. Often application forms, where these are required, are also available. In general, the novice researcher will have more success with local or specialized funding agencies than with prestigious national organizations. However, a small initial grant may be all that is required to complete a pilot project and thereby start to build a track record in research.

The Project

The beginning researcher should select a title which accurately describes the work, as the title is often the main source of information used in selection of referees for the application. The title should also be designed to appeal to the funding agency, particularly if it is a specialized one.

Requisite Training

First, the funding agency will review whether the applicant has the appropriate training to carry out the project. Thus only those types of projects should be chosen for which the dental hygienist has the required research training. If there are aspects of the project for which the dental hygienist has not been trained, or requires help from someone else, it would be appropriate to attach a letter to the application from the potential collaborator to confirm that he/she agrees to assist in the project.

Review of the Literature

The second major area to be examined by a funding agency is whether the applicant is familiar with the relevant literature. Particularly for a new applicant to a funding agency, or an applicant without a publication record, it is very important to demonstrate a thorough knowledge of the field and quote the most important papers by other workers. Once an applicant has become established in research and has a good publication record, there is perhaps less necessity to review the literature in detail, but the applicant should always demonstrate familiarity with the most recent research in the area.

Previous Work by the Applicant

Most granting agencies are relatively conservative and like some assurance that if the project is supported, the applicant will actually be able to carry it out. Thus it is invaluable if the applicant has some preliminary results or has conducted a pilot project or small field trial to demonstrate his/her capability. This is particularly true if the research involves complex methodology and the applicant has no publications to illustrate competence in the techniques to be employed. The other advantage of a pilot project, which can often be supported by institutional funds, is that it frequently leads to modification of the proposed main project because of difficulties which arise. For example, most potential subjects might be willing to complete a survey which takes five minutes of their time but might balk at one requiring two hours. Such information could be established by the pilot project.

The Hypothesis to be Tested

Surprising as it may seem, many applications to funding agencies do not contain a testable hypothesis. Even if such projects are given all the funding requested, very little useful information is likely to be derived. Thus the applicant should have a definite hypothesis and should design the project in a way that it can be tested. Since, in most instances, some sort of statistical analysis will have to be applied to the results, it is best to discuss the project design with a statistician *before* it is begun. Otherwise the statistician may discover a fatal flaw at a time too late to correct the design.

For certain types of research the statistician will be able to give information on the number of subjects required to test a particular hypothesis. To do this it will be necessary to know the expected degree of variability in the results, which may already be available in the literature or may be derived from a pilot project. In animal studies, many researchers believe that the number of subjects required to test a hypothesis is inversely related to the size and expense of the species employed. Thus in studies on mice they may consider 50 animals per group to be ideal but that with elephants or monkeys, two or three will suffice! If the number of animals required for a particular statistical analysis is not available or they are too expensive, the project will be worthless with fewer animals.

Granting agencies usually like to see some degree of novelty or originality in a proposal. They will rarely support work which appears to duplicate work already published. If the project does duplicate previous work to some extent, a full explanation of the necessity for this should be given.

The work proposed should obviously be relevant to the funding agency being approached and should preferably be in an area of stated priority. The overall significance of the work and its long-term potential should also be made clear.

Methodology

The applicant must describe in some detail the methodology to be employed and the method of data analysis to be used. If the applicant has already used the methods in previously published research and has reprints available, less detail would be required. Again, it is very useful to have some preliminary results to show familiarity with the techniques to be employed. If any difficulties with the methodology can be anticipated, these should be identified and not glossed over; alternative procedures should be discussed.

If the project involves human or animal subjects, it will be necessary to receive approval from the local committee on the use of human subjects or animals before submitting it to a funding agency. With human subjects, appropriately worded consent forms will also be required.

Budget

In general, the more costly the project, the less likely it is to receive funding, particularly for a beginning investigator. All items in the budget should be explained in reasonable detail and the duties of any personnel requested should be clearly outlined. It is important not to "pad" the budget as this creates a bad impression of the whole project and most funding agencies or their referees have a fairly good knowledge of the actual costs of research. Preliminary inquiries should be made about whether the agencies will fund such items as indirect costs of research (overhead) and travel to research meetings.

Publications

No project can be considered complete until it has been published, preferably in a refereed journal. Funding agencies usually pay strong attention to the publication record of the applicant, particularly for renewal applications.

In general, abstracts count for virtually nothing as these are rarely refereed. Even a new applicant can be expected to have some publication record, perhaps emanating from his/her thesis research. Granting agencies tend to be more impressed if the new applicant is the sole author of any publications or at least the first author if there are multiple authors.

With established investigators, a good case can be made, in my opinion, for funding them more on their recent publication record than on the actual proposal submitted. This is because the best assurance of a funding agency about the applicant's ability is his/her success in previous studies. Well refereed journals usually provide excellent quality control of the published work.

Submission of Application

Most agencies have application deadlines which must be adhered to with often only one competition per year. Thus planning is necessary well in advance of the deadline.

Perhaps the most important advice that can be offered is that after writing the application and before submitting the project to a funding agency, knowledgeable colleagues should be asked to offer a critical review. It is far better to get a critical review at home than by the referees for the funding agency. Most agencies keep a record of the success or otherwise of applications and a record of previously unsuccessful applications by a potential investigator creates a negative impression on an awards committee. Therefore, an applicant should be entirely satisfied with the application before submitting it, even if this delays the application by several months.

NATIONAL HEALTH RESEARCH AND DEVELOPMENT PROGRAM

Ron A. Heacock

Introduction

I would like to thank the organizers of the conference on Dental Hygiene Research most sincerely for inviting me to talk to you about the *National Health Research and Development Program (NHRDP)*. I always welcome the opportunity to meet members of Canada's health research community in order to explain what the NHRDP is all about and what we can do to help them.

The primary objective of the NHRDP is to provide support for scientific activities designed to yield information (i.e. new knowledge) needed by the *Department of National Health and Welfare (DNHW)*. The department's requirements in this area arise from its multitude of statutory functions and responsibilities, and not all of them can be addressed "in house".

The NHRDP has existed in its present form since 1974. It was formed by the amalgamation of two separate departmental research funding programs which were in operation at that time, namely the *National Health Grant* and the *Public Health Research Grant*. The former had been in existence since 1969 and was designed specifically to support research on the delivery of care and the health care system itself. The latter was much older and was one component of the *General Health Grants Program*, introduced by the department in 1948. This federally funded but provincially administered multi-grant program was introduced in the years after the Second World War with the overall purpose of strengthening and developing the Canadian health system. The funds enabled the provinces to launch a variety of health-related activities, including research.

The *Public Health Research Grant* provided support for a wide variety of what might loosely be termed "applied health research" activities, in areas such as environmental health, infectious diseases, immunization, epidemiology, etc. The present day NHRDP currently incorporates all the elements of both these antecedent programs.

DNHW Funding Programs

In addition to the NHRDP there are several other grants and contributions programs elsewhere in DNHW which have been designed to meet a variety of health and social service needs. On the "health" side of the department for instance there is the *Health Promotion Contribution Program (HPCP)*. This program evolved recently from the program for Research on Drug Abuse, which was housed in the former Non-Medical Use of Drugs Directorate of DNHW. It now provides support to organizations for conducting projects consistent with departmental health promotion objectives. The overall aim of the health promotion program is to inform and motivate people to adopt behaviors and health practices that contribute to the adoption of healthy lifestyles, the maintenance of good health and the avoidance of health risks. The contribution program supports four types of health promotion activities:

1. *Resource development* — for the production and distribution of health information and education materials;
2. *Education and training* — for health education programs aimed at the public and special groups, and training programs for health professionals;
3. *Organizational development* — to assist voluntary and community organizations and self-help groups to undertake health promotion activities; and
4. *Demonstration* — to test the effectiveness of innovative health promotion programs.

The HPCP does not support research projects in health promotion; applications for research support in this area are considered by the NHRDP.

Also on the health side of the department, the *Family Planning Grants Program* supports the development of services which permit Canadians to make informed decisions about family size and the spacing of children; it also provides some limited funding for research and training programs in this area.

On the welfare "side" of the department, the *National Welfare Grants Program* makes funds available to provincial and municipal welfare departments, voluntary agencies, citizen groups, universities and other organizations to conduct research, demonstration and manpower development projects in the general area of social welfare. The *New Horizons Grants Program* provides funds to groups of senior citizens to encourage participation in community activities. This non-research oriented program is designed to help seniors utilize their skills, talents and experience to benefit their community. Projects supported include sports and recreation, crafts and hobbies, historical, cultural and educational activities, social service projects and activity centres.

Sustaining grants are provided to a number of national voluntary organizations; programs offering this form of support exist on both the Health and Welfare "sides" of the department. On the Health side of the department the *National Voluntary Health Agency* program performs this function, whereas on the Welfare side, such support is provided as a component of the *National Welfare Grants* program.

Although it is not a part of the department, I should say a few words about the *Medical Research Council (MRC)*. The MRC started life some 35 years ago as a division of the *National Research Council (NRC)*, but has enjoyed a fully independent existence since 1969. The MRC, like its sister Granting Councils the *Natural Sciences and Engineering Research Council (NSERC)* and the *Social Sciences and Humanities Research Council (SSHRC)*, is a crown corporation which operates at "arms length" from government, and exists for the express purpose of promoting and assisting university research and the development of research manpower. The main function of the MRC is to encourage and support basic biomedical and clinical research in the health and life sciences. The MRC, in financial terms, is the major supporter of health sciences research in Canada today. The NHRDP is located in the same office building in Ottawa as the MRC. This makes for frequent contacts and I think it is fair to say that an excellent working relationship exists between the two programs.

Figure 1 indicates the 1981-82 and 1982-83 budgets for these departmental programs and gives contact addresses in Ottawa. This figure also gives the relevant information for the MRC, which I must stress is not part of the department, although it reports to Parliament through the Minister of National Health and Welfare.

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Program	Budget 1981-82	Budget 1982-83
National Health Research and Development Program Health Services and Promotion Branch Room 420, Jeanne Mance Building Tunney's Pasture Ottawa, Ontario, K1A 1B4	$11,153,000	$14,030,000
Health Promotion Contribution Program Health Services and Promotion Branch Room 512, Jeanne Mance Building Tunney's Pasture Ottawa, Ontario, K1A 1B4	$ 2,099,000	$ 4,000,000
Family Planning Grants Program Health Services and Promotion Branch Room 662, Jeanne Mance Building Tunney's Pasture Ottawa, Ontario, K1A 1B4	$ 1,099,000	$ 1,099,000
National Voluntary Health Agencies Program Health Services and Promotion Branch Room 611, Jeanne Mance Building Tunney's Pasture Ottawa, Ontario, K1A 1B4	$ 442,000	$ 422,000
New Horizons Programs Social Service Programs Branch Room 640, Brooke Claxton Building Tunney's Pasture Ottawa, Ontario, K1A 1B5	$12,400,000	$12,734,000
Welfare Grants Program Social Service Programs Branch Room 756, Brooke Claxton Building Tunney's Pasture Ottawa, Ontario, K1A 1B4	$ 3,300,000 1,700,000* $ 5,000,000	$ 3,300,000 1,700,000 $ 5,000,000
***Amount to National Welfare Voluntary Agencies**		
Medical Research Council 20th Floor, Jeanne Mance Building Ottawa, Ontario, K1A 0W9	98,400,000	110,908,000

FIGURE 1. DEPARTMENT OF NATIONAL HEALTH AND WELFARE, DEPARTMENTAL PROGRAMS, CONTACT PERSONNEL AND BUDGET

The categories of assistance that were available under the various departmental programs in 1982-83 are shown in Figure 2.

Types of Assistance Available	NHRDP	NVHA	Family Planning	HPCP	New Horizons	Welfare Grants
Research And Development	x		x			x
Research Career Support	x		x			x
Research Training Support	x					x
Demonstration Projects	x		x	x	x	x
Surveys And Analyses of Data	x		x	x		x
Health Services Development		x	x	x		
Health Skills Development			x	x		
Welfare Services Development					x	x
Welfare Skills Development						x
Sustaining Grants		x	x			x
Pilot Projects And Start-Up	x			x		x
Publication Funds			x	x	x	x
Conferences/Workshops	x		x	x	x	x
Special And Short-Term Projects	x		x	x	x	x
Resource Materials Development				x	x	x

FIGURE 2. DEPARTMENT OF NATIONAL HEALTH AND WELFARE GRANTS AND CONTRIBUTIONS PROGRAMS (1982-83)

The National Health Research and Development Program

For the remainder of my talk, I would like to discuss the operations of the NHRDP in more detail describing how we put $14 million to work on behalf of health research in Canada. Basically it is possible to divide the NHRDP activities into two major categories: the support of *Research Activities* and the direct support of *Individual Researchers*.

NHRDP, Support of Research Activities

Categories of Assistance. The support offered for *Research Activities* can be subdivided as follows:

1. ***Research Projects*** — Original investigations undertaken on a systematic basis to acquire scientific or technical knowledge for the purposes of applying it to the solutions and or management of problems.
2. ***Demonstration Projects*** — Projects which involve the implementation and evaluation of innovations in the organization or delivery of health services. Special emphasis is always placed on the proposed evaluation strategy and methodology in the course of consideration of projects of this nature. A separate principal investigator should preferably be named for the evaluation component.
3. ***Studies*** — The systematic collection and/or analysis of new or existing data.
4. ***Preliminary Development Projects*** — The development and evaluation of prototypes of new devices, equipment, systems and procedures, relevant to health, or health care, on a national scale. It should be noted that this category of support does not include demonstration projects involving innovative service delivery systems without a well developed evaluation protocol.
5. ***Symposia, Workshops and Conferences*** — Contributions can be made towards the cost of research-oriented national or international meetings organized by Canadian sponsors, held in Canada, which deal with important health issues.
6. ***Formulation Funding*** — This enables applicants who lack ready access to technical assistance and advice (e.g. statistical and epidemiological consultation), library resources etc. to develop innovative ideas into viable research proposals. This part of the overall program is not normally aimed at university faculty members, except in cases where multidisciplinary studies are involved. Receipt of formulation phase assistance does not imply that the resulting proposal will automatically be funded.

Project Duration and Budgets

In theory there is no limit on the length of time a project can run, but the average project life is about 3 years. The maximum allowable budget according to our terms and conditions is $1,000,000 per year; in theory there is no specified maximum amount that can be paid out for any particular project. The average annual project cost in 1981-82 was approximately $40,000 p.a. The limit for formulation phase support is $15,000. The usual limit for conference support is $5,000, but the amount of funding available for conferences will depend on the state of health of the Program budget at any given time. In any event it is not our policy to pay all conference costs.

Review Procedures

I would now like to explain the NHRDP review procedures, which, I sincerely believe, are among the fairest and most comprehensive to be found, not only nationally but at the international level.

Applications are initially screened for completeness and to see if they fit the terms of reference of the Program. If the subject matter of an application is not suitable for its consideration by the NHRDP, we will do all we can to find a more appropriate agency to which it could be referred (e.g. MRC, SSHRC, Welfare Grants etc.).

The actual selection process involves an assessment by departmental officials for *relevance* to the goals and objectives of DNHW and an assessment of *scientific merit*, which is carried out by a peer review process involving both written reviews by external experts and Committee review (See Figure 3).

	Relevance	(Department, Province)
Scientific Merit	Significance	(External Experts)
	Methodology	(Peer Review Committee)

FIGURE 3. ASSESSMENT AND APPRAISAL PROCESS OF THE NATIONAL HEALTH RESEARCH AND DEVELOPMENT PROGRAM

I have just referred to the departmental *relevance* review. In order to expand on this somewhat, I think it would be appropriate to give a brief overview of the activities of the branches that make up the health side of the department. Their programs, legislation and interests determine, by and large, the scope of the NHRDP. The major organizational groups within the department are shown in Figure 4.

Health Protection
Medical Services
Health Services and Promotion
Principal Nursing Officer

Policy Planning and Information
Intergovernmental and International Affairs
Administration

Income Security
Social Services Programs
National Council on Welfare

FIGURE 4. BRANCHES OF THE DEPARTMENT OF NATIONAL HEALTH AND WELFARE (HEALTH ASPECT)

The *Health Protection Branch*, which is concerned with the identification and elimination of man-made or naturally occurring hazards in the physical environment, has obvious interests in areas such as air and water quality, food and drug safety, disease surveillance, and so on. Some of the more "traditional" public health concerns are diminishing ones — the incidence of tuberculosis in Canada continues to fall for example — but industrial innovation and technological change seem to provide us with a never-ending supply of new concerns: the health effects of "acid rain" and the health implications of energy-efficient homes and offices (urea-formaldehyde foam insulation) for example, are relatively new problems.

The *Medical Services Branch*, which has responsibility for delivering health services to such diverse groups as Canada's armed forces and public servants, native peoples, and immigrants, has, as might be expected, a continual need for new research generated information. Their interests might well range from evaluations of the quality of care provided by nurse-practitioners in remote locales, with no direct or immediate access to physicians or medical specialists, to the development of new and better prosthetic and orthotic devices, and even to the development and evaluation of educational programs aimed at reducing injuries in the workplace.

The third of the department's three health branches, *Health Services and Promotion*, is concerned with ensuring that provincial hospital and medical care insurance plans, more than half the costs of which are financed by federal contributions, including tax transfers, continue to offer reasonable accessibility to insured health services of acceptable quality. The federal government also makes substantial contributions to the provinces in respect to extended health care services. In view of the size of the federal investment in provincial health plans — about $8.5 billion in 1982/83 — this Branch is also concerned with the efficiency of health care practices and the promotion of "good" health as a means of reducing the demand for insured services while helping Canadians enjoy longer, healthier and happier lives. The range of

research issues of interest to Health Services and Promotion is considerable. It would include such areas as: the supply of and demand for health professionals; the influence of premiums of user fees on the demand for health services; hospital architecture; and the evaluation of the efficacy of screening programs aimed at the early detection of disease.

The assessment of *scientific merit* is carried out by a peer review process, similar to those employed by many other funding agencies. At least three written assessments of any application are obtained from experts in the field. These reviews are then made available to the multidisciplinary committees that review the proposals.

We currently have eight committees for the review of project applications. Four in the social sciences/health care delivery area (two for relatively "soft" methodologies, two for "harder" methodologies), and one each in: epidemiology/chronic diseases/occupational health; microbiology and infectious diseases; biochemistry/toxicology/environmental health; and rehabilitation/biomedical engineering.

Criteria which are examined during the review of proposals included such items as:

1. clear statements of objectives;
2. sound application of scientific methods and instruments;
3. feasible research design(s);
4. adequate surveys of past work in the area of study, including relevant bibliographies, etc.;
5. satisfactory progress reports in the case of requests for "continuing" support;
6. potential ability of the team to carry out the project; and
7. reasonableness of the proposed budget.

Partial funding by other agencies, e.g. the MRC, provincial government departments, and non-governmental sources (such as the National Cancer Institute of Canada), does occur from time to time, and is in fact welcomed to either complement the activities supported by the NHRDP or to share total costs. Duplication of funding of the same parts of any research proposal by two or more agencies is not permitted.

Support may be recommended on a conditional basis to applicants where compliance with the review committee or departmental recommendations regarding certain aspects of the proposed research project is a necessary prerequisite for funding. Site visits by NHRDP review teams (which may be composed of both internal and external experts) can result in a recommendation to fund a proposal about which a review committee had previously entertained some doubts. The site visit mechanism can also be used to bring an ongoing project in difficulties back "on track".

NHRDP, Support Of Individual Researchers

In addition to providing support for research projects the NHRDP also recognizes the need to train health research manpower, and to "liberate" university faculty members from their teaching and administration assignments so as to permit them to spend more time in research. The NHRDP supports these activities through its *Training* and *Career Awards programs*, as shown in Figure 5.

Training	Career
Short Term Studentships	N.H. Research Scholars
M.Sc. Fellowships	N.H. Scientists
Ph.D. Fellowships	Visiting N.H. Scientists
	Postdoctorate Fellowships

FIGURE 5. NATIONAL HEALTH RESEARCH AND DEVELOPMENT PROGRAM SUPPORT OF PEOPLE

Research Training Support. In this category, support is available in the form of *MSc and PhD Fellowships* to enable suitably qualified candidates to work towards a PhD or research-based MSc degree for up to five years (two years for the MSc) in the nonbiomedical or nonclinical health sciences, such as health economics, biostatistics, epidemiology, medical sociology, nursing etc. The *Short-term Studentships*, which are essentially the same as what is generally known as summer studentships, are to enable senior undergraduate students to obtain research experience during vacation periods. This aspect of the program is subject to the availability of funds.

Research Career Support. For the individual who has completed all formal research training, but wishes to acquire supervised "on-the-job" training in research, there is the *Postdoctoral Fellowship (PDF)* program (two years). This is a relatively new program for the NHRDP and it doesn't really fit either the Training or Career categories of personnel support. In effect, the NHRDP PDF program is similar to the PDF programs that have existed (NRC, NSERC, MRC etc.) over the years in the basic sciences.

For more senior personnel, we have two categories of awards: the *National Health Research Scholar Award* and the *National Health Scientist Award*. The *National Health Research Scholar Award* is designed for individuals who have completed all formal research training and already have a few years postdoctorate research experience. This award, which can be made for a period of up to five years, enables candidates with demonstrated ability to prepare for a full-time career in research. Scholar award recipients are generally people at the assistant/associate professor (or equivalent) level. These awards are normally tenable at universities, but they could be held in other suitable research settings such as might be provided by provincial health departments, voluntary health agencies, or professional organizations.

The *National Health Scientist Award* is our most prestigious award and is designed to enable internationally recognized Canadian health scientists to pursue a full-time research career. Candidates would normally be researchers who are already at the full professor (or equivalent) level. One of the conditions of appointment for this Award, (as for the Scholar Award) is that the individual must spend at least 75 per cent of his/her time in research activities. The remaining 25 per cent can be spent teaching, consulting or in other professional activities.

It should be noted that in all cases it is the host institution that applies on behalf of the National Health Scientist or Scholar, thus involving a university commitment to the individual for provision of space and support facilities in addition to the time commitment mentioned above.

Another category of career award, the *National Health Visiting Scientist Award* is designed to:

1) enable distinguished health research investigators from outside Canada to work in a Canadian institution for periods of 3 to 24 months; and
2) to assist recognized Canadian investigators to spend up to 12 months, while on sabbatical leave, in another institution either within or outside Canada. The Visiting Scientist awards only afford partial salary support, to help make the candidate's reduced sabbatical salary up to a normal academic salary.

The review of applications for either Career or Training Awards is carried out by suitably constituted multidisciplinary peer review committees. In the past the deadline for receipt of applications for Project and Career Award support was July 31 in any year for potential funding effective April 1 in the subsequent year. We will be making a deadline change in 1983. For a combination of reasons we have decided to institute a new deadline for projects, namely December 1, for possible funding effective July 1 in the subsequent year. We will endeavour to ensure that no investigators suffer by virtue of the three months hiatus in funding that might occur by virtue of the shift from April to July funding dates. No change is contemplated for the moment in the Career Awards application deadline. In the past the Training Awards deadline has been November 15, we are now in the midst of changing this, as a result of numerous requests, to February 15. We may adopt this deadline for PDF applications as well at some point in the future. There are no deadlines for applications for Conference or Formulation phase support, or for "small"projects (i.e. projects with a budget of under $15,000 and which are not expected to last longer than 12 months). Applicants are, however, strongly advised to check with us before submitting, since Program funds for these categories of support often tend to be committed, at a relatively early date in the fiscal year.

Current Priorities

In December 1981 we were able to announce a "special competition", to be held in the Spring of this year for the funding of research projects in areas of high departmental priority. We had previously canvassed our colleagues in the department to determine how they

viewed their priorities, and we were able to classify these topics according to the current main departmental thrust areas:

1. Chemical, physical, biological and psychological health hazards in the home, workplace and natural environments.
2. Primary and secondary illness prevention, including the development of physical and mental health promotion strategies.
3. The extent to which health care policies and practices may or do impact on the availability, accessibility and quality of health care.
4. Habilitation and rehabilitation of the disabled and handicapped.
5. Health of native peoples.

We were, in fact, overwhelmed by the response to our special competition, and we received three times the expected numbers of applications. This will create some financial problems for us, both for the current fiscal year and for 1983-84. We had wondered if this would lead to a reduced number of applications for our regular July 31 competition. This was not, in fact, the case, which has further complicated the 1983-84 financial picture.

Conclusion

I hope that you now have a clearer picture of the NHRDP, what it is trying to do and where it fits into the overall Canadian health research scene. We publish separate guides (manuals) annually for the Research Project, Training Awards and Career Awards parts of the Program. We also publish an annual inventory of projects supported and awards made. From time to time we issue newsletters, as reminders and highlighting any program changes. Examples of these publications are available upon request.

DIRECTIONS FOR DENTAL HEALTH PROMOTION RESEARCH

Dexter A. Harvey

Introduction

Health promotion emerged as the new vanguard concept in health programming during the 1970s, replacing the older practice of health education. The introduction of health promotion was accompanied by a plethora of definitions, each unique to a particular purpose but contributing little to a universal understanding. To complicate matters, health education which suffers also from a multitude of definitions is used in the literature interchangeably with health promotion.

Before addressing directions in dental health promotion research, it is imperative to examine the definition and scope of health promotion to ascertain program parameters. Hoke has defined health promotion as "the process of enhancing an individual's capacity to positively influence his health and overall well-being."[1] The United States Department of Health defines health promotion more specifically as "any combination of health education and related organizational, economic and environmental supports for behavior conducive to health."[2] It appears from the literature that health promotion is a process aimed at developing awareness and influencing attitudes and behavior, both of the individual and the community at large, towards achieving optimum levels of health and social well-being. The end products of health promotion are behavior conducive to health and improved quality of life.

The foregoing definitions of health promotion give a new meaning to the function of preventive health. Health promotion has a central focus directed at the continuous improvement of health to higher standards through the modification of deleterious personal habits and the consequential reduction and elimination of personal risks. Health promotion utilizes a positive orientation of encouraging higher levels of wellness for a better quality of life rather than the adoption of behaviors to prevent specific illnesses and diseases. It is this positive orientation that distinguishes health promotion of the 80s from the earlier practice of health education. Health education programs were mostly directed at educating people on how to prevent disease. This does not mean that health promotion is not preventive health. It is, but instead of an orientation based on the prevention of disease the orientation is on the attainment of high levels of wellness leading to an improved quality of life. The prevention of illness and disease is concomitant with the attainment of higher levels of wellness.

The scope of health promotion is most easily ascertained by examining the activities most commonly employed to promote behaviors conducive to health. These activities can be categorized as Advocacy, Social Marketing, Community Organization, Mass Media, Legislation and Health Education (see Figure 1).

FIGURE 1. HEALTH PROMOTION CATEGORIES OF ACTIVITIES

Advocacy is a specific form of education utilizing strategies designed to educate decision makers to provide the essential political support for healthier changes. Advocacy is generally a precursor to legislation.

Legislation is not necessarily an activity in itself but the result of activities. Legislation contributes to health promotion by making mandatory certain behaviors and activities conducive to health. Legislation is often referred to as "managerial prevention". Mandatory seat belt use is an example of legislation.

"Social Marketing is the design, implementation and control of programs seeking to increase the acceptability of social idea or practice in a target group(s). It utilizes concepts of market segmentation, consumer research, idea configuration, communication, facilitation, incentives and exchange theory to maximize target group response."[3]

Mass Media are the channels of communication through which many diverse groups of people may receive a message.

Community Organization is a process aimed at developing the skills, abilities and understandings of groups of people for the purpose of self-led improvement.

Health Education as a category of activity deserves some elaboration. Green *et al*. define Health Education as "any combination of learning experiences designed to facilitate voluntary adaptations of behavior conducive to health."[4]

The two key concepts of this definition are that learning experiences are designed for a particular purpose and that purpose involves freedom of choice. Voluntary is a key term in the definition of health education. The individual has the freedom of choice to adopt or not to adopt behaviors conducive to health. From the above definition it can be seen that health education may be included as a part of health promotion while some health promotion activities may not be health education.

Health education generally utilizes two broad categories of educational methods. One category can be called communication methods which focus on knowledge and attitudes. Communication methods include lecture-discussion, counselling or instruction, audiovisual techniques, computer-assisted learning and programmed learning. The second category can be called training methods which focus on skill development. Training methods include demonstrations, modelling, role playing, simulations and games, inquiry learning and behavior modification. Most health education undertakings utilize both communication and training methods to get at the knowledge, attitude and skill components that predispose and enable behavior conducive to health.

The scope of health promotion activities is extensive and so are the parameters of programming. Opportunities for research are abundant and the need for such research is great, particularly for the purpose of allocating resources.

Forms and Purposes of Health Promotion Research

Research in the field of health promotion has two major purposes, to advance knowledge and to guide decisions. The advancement and expansion of the knowledge base about salient variables in health promotion enable health promoters to better understand the complexities of the field in which they function. Activities aimed at knowledge base expansion are commonly referred to as *research*. In a field such as health promotion which continuously must compete for scarce resources, research for the advancement of knowledge is not enough. The collection of information to permit decision making about specific health promotion programs is most useful in making resource allocations. Activities providing information related to program planning, implementation, impact and efficiency are referred to as *evaluation research*.

Both research and evaluation research play crucial roles in health promotion programming. However, profound economic crisis and

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declining funds for all health programs have stimulated a need to make a strong investment in evaluation research as a means to strengthen and preserve existing programs or justify new efforts. Costs for programs seem to spiral annually thus resulting in administrator demands for information to justify program existence. Sources of information are needed upon which informed decisions can be made. Coupled with the competition for funds is the lowly position health promotion programs hold in the hierarchy of total health programming. Health promotion programs will only be accepted when they can demonstrate efficacy and cost effectiveness and this will only occur if evaluation research becomes a priority undertaking. For this reason, four types of evaluation research will be discussed.

Rossi *et al.*[5] distinguishes among four types of evaluation research: research for program planning, program monitoring, impact assessment and efficiency calculations.

Program Planning Research is commonly referred to in the literature as needs assessment and exploratory evaluation. This type of research is primarily used during the planning and designing phase of a program. This research is designed to identify problems and their locations; to identify the target population(s) with the problem; to identify in operational terms the knowledge, attitudes and behaviors to be attained by the program; and to determine whether the proposed program is a suitable intervention for the problem to which it is directed. Program planning research plays a vital role in determining program directions.

Program Monitoring Research examines whether a program is operating in conformity to its design, and whether it is reaching the specified target population. Monitoring research should provide empirical evidence verifying that what was paid for and deemed necessary was in fact implemented and that it was received by the appropriate participants. Monitoring research occurs during the implementation of the planned program which is based upon program planning research or an acceptable alternative.

Frequently programs are not implemented as planned. Sometimes personnel and equipment are not available, program staff may lack the motivation or know-how to carry out designated tasks and there may be times when there are insufficient numbers of the designated target population. In some instances, after a project has started, the cost of locating potential participants is so high that little funds remain to support an effective intervention program. Knowledge about the implemented program is essential in assessing program process. Monitoring research should verify exactly what the program was like so that one has a perspective of what was in place to effect an impact.

Program Impact Research is used to determine the extent to which a program brings about changes in desired and undesired directions. Impact research should indicate the degree of success attained in reaching program objectives. This is done by demonstrating that what occurred in the target population was the result of a particular program and could not be accounted for in other ways.

Program Efficiency Research deals with considerations that concern economics. It is not enough to know that a program has an impact, the cost of this impact must be ascertained before decisions can be made about future monetary support. Questions related to the ratio of benefits to cost incurred and the comparison of the number of benefits per unit of outcome costs of a given program to other programs designed to attain the same goals are examples to determine efficiency calculations.

The preceding four types of evaluation research should be viewed as an incremental activity where program planning research identifies the problems and target populations for the purpose of program design; then program monitoring research determines exactly what was implemented; then impact research determines whether the program resulted in attaining the intended outcomes and then program efficiency research ascertains efficiency. In most instances program planning occurs without the benefit of needs identification research or is based on research done by others. At the very least, monitoring, impact and efficiency research are needed to provide a comprehensive evaluation of a given program. Although comprehensive evaluation is preferred, any one of the four types of evaluation research may be done depending upon needs and resources. Research needs to be done — the future of dental health promotion rests on the results.

Although research for the expansion of knowledge and evaluation research are of equal importance, the current economic climate and the lowly status of dental health promotion place evaluation research in a priority position. A demonstration of effectiveness will be essential in making decisions about future dental health promotion efforts.

Needed Research in Dental Health Promotion

It is an understatement to say that research is needed in dental health promotion. Programs can no longer be based on folklore, instead they must be based upon sound empirical evidence. The following are some of the many questions that need to be answered through research in order to establish an empirical base for dental health promotion programming:

1. We know that dental health promotion works if it is sufficiently adapted to the population, the problem and the circumstances in which it is implemented. What we do not know is how to describe these adaptations.
2. What body of knowledge is available on dental health promotion? This knowledge is the result of program replication with suitable accompanying research in many similar and diverse settings. Theory building depends upon replicated results.
3. What established models have been developed for the systematic planning and evaluation of dental health promotion programs?
4. What is the effectiveness of each of the various techniques applied in dental health promotion to bring about desired changes?
5. What are the optimum times in the life of a dental health program or problem when dental health promotional inputs will minimize risk of failure and maximize payoff?
6. How can motivational psychology be applied to dental health?
7. How do people's beliefs, attitudes, values, motives and practices affect dental health promotion programming?
8. What types of dental health promotion programs are effective with high risk populations? Why?
9. How do social factors such as the role of the family, of peer group influences, of professional workers, of schools and of the community affect the adaption of dental health practices?

The foregoing questions are just a sample. They cover areas of need which if answered will provide a sound foundation for the planning of dental health promotion. The challenge and the search for knowledge are yours.

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BEHAVIORAL AND SOCIAL SCIENCE RESEARCH FOR ORAL HEALTH

Lois K. Cohen

Introduction

It has been nearly three decades since social and behavioral scientists began to devote some of their research attention to oral health topics. The convergence of mutual interest in promoting oral health through the application of behavioral and social scientific theory and methodology to oral health and disease-related phenomena has occurred in a rather piecemeal fashion. Despite that growth characteristic, there is some sense that critical masses of significant literature in several areas have emerged.

If one looks at the areas reviewed in the 1971 publication, *Social Sciences and Dentistry*,[1] it is evident that between 1955 and 1970 there were at least 10 distinct areas of investigation warranting a "state-of-the-science" review: career choice, techniques related to health professions' education, dental manpower and distribution, characteristics of dental practice, continuing education, dentist-patient communications, utilization of dental services, health education of children and adults, social factors related to disease epidemiology, and fluoridation.

A soon-to-be published updated review of the literature available from the Fédération Dentaire Internationale, expands these areas to include subjects such as: psychosocial correlates of variations in oral-facial structure and function; sociodental indicators of impact of oral health, diseases, conditions and treatments; behavioral aspects of dentally relevant physiological functions; diffusion and adoption of research findings; as well as material on systems of delivery of care. The range of foci for research is broad though not exhaustive of all that might be researchable or even significant for purposes of oral health. However, these reviews can provide an investigator with an orientation to the literature, necessary to sharpen the research questions and focus them on critical policy issues.

Research Needs

In an attempt to enumerate a few topics, which potentially might be challenging to the dental hygiene profession, I will not try to be complete nor comprehensive. Rather my intent is to provoke the imagination, posing questions for discussion, debate and even culling.

Given the severe limitation in financial resources that is current, effective public policies are critical. Recognizing that research cannot ensure the success of policies either in the public or in the private spheres, it can minimize failure by providing more rational bases for rendering decisions. The question of utilization of research data for decision-making is most significant, as policy-researchers incorporate the views of the potential utilizers in the design of the research itself. While this subject requires a separate discussion and time precludes that today, I raise it for consideration. For even under the most ideal circumstances, utilization of research findings is influenced by a variety of factors including: the mode of communication, the organizational context, the political and economic environment, the availability of other data-sets consistent with the research in question and client commitment, among other elements. In lieu of a full discussion on this topic now, I refer you to an excellent study of the subject in a book by Carol Weiss and Micheal Bucuvalas, *Social Science Research and Decision-Making*.[2]

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In my mind, the most critical issue facing the oral health community today is the problem of converting unmet need for oral health care to effective demand for self-care and for professional services. Despite the apparent decline in the prevalence of dental caries in most industrialized countries of the world,[3] there is considerable backlog of treatment need for caries, as well as diagnostic, preventive and treatment needs for such oral diseases and conditions as periodontal diseases, conditions related to craniofacial structures and disorders of the supporting soft tissue. If one accepts that the greatest burden of work for dental professionals has been the prevention, diagnosis and treatment of dental decay, and that these tasks have primarily been assigned to the dentist, then it follows that a decline in the burden of workload will mean some reassessment of duties, not only for the dentist but for all supporting personnel. Thus, the division of labour among oral health professionals, and, most importantly, the addition of new heretofore unaddressed tasks in areas related to oral health promotion outside the dental facility, could become the "hot" topics for dental policy-research. Converting unmet need to demand involves innovative ways to uncover need for potential care of consumers in places where they are located... in homes, in offices, in community centres and institutions. Who does these tasks, who is trained or retrained to address these duties will be of equal importance as that which is done to achieve the ultimate demand for services. Who pays for these tasks will be significant as well as who are the performers and how the quality of these tasks are monitored and evaluated. Up until this point in history, the issue of "out-reach" to the public has been primarily in the public health domain. The private sector has done little, unless one considers the recent trend toward advertising and occasional dental health education presentations to be sufficient. Systematic programs administered and implemented by oral health professionals, which seek specifically to convert unmet need to demand on periodic schedule, have not been initiated on a large scale, to my knowledge.

A major concern of the National Institute of Dental Research and the U.S. Public Health Service totally, is the need for adequate research information on the application of preventive procedures, and on incentives for and inhibitors of the adoption of preventive behaviors. Research is needed which is designed to test viable action models to optimize preventive behaviors of the profession, the various subgroups of the public, and administrative institutions. This research ought to be experimentally designed in natural, not in contrived settings. Focusing on program elements which are mutable, the results of the research might provide directives to administrators which might enhance their ability to maximize program effectiveness and efficiency.

Oral health promotion and disease prevention research, of course, are linked closely with the need to convert need to demand. In this instance, I am addressing the use of health education, in combination with organizational, political and economic interventions to influence the broader community and family networks and institutions in which people attempt to exercise their rights and responsibilities. Health education, alone, is any combination of learning experiences designed to predispose, enable and reinforce voluntary adaptations of behavior conducive to health.[4,5] Both concepts, health education and health promotion, are necessary ingredients to measure and evaluate if the idea of conversion of need to demand is considered seriously by the dental professions.

It has been the traditional strategy by oral health personnel to attempt behavior change by providing instruction on oral hygiene techniques to patients and students. The basic assumption underlying this approach is that information dissemination will evoke favorable attitudes towards the preventive behavior, which in turn will result in the adoption of the appropriate action. One reason for that lack of relative long-term success of these methods, appears to be the failure to appreciate the significance of incentives and inhibitors in the environment. The availability, accessibility and acceptability of dental ser-

vices, oral hygiene products, non-cariogenic foods, preventive self-care procedures, or more passive efforts such as water fluoridation may or may not be present in the social context in which targeted individuals live. Research then needs to focus on such environmental elements which might be appropriately manipulated to enable and facilitate preventive behaviors. An excellent review of this literature was prepared by Silversin and is contained in a recent special topic issue of the *Journal of Behavioral Medicine*, devoted to the proceedings of a 1980 National Research Conference on Oral Health Behavior.[6]

There are many other dental policy-relevant issues ripe for behavioral and social research. Among them are matters concerning the optimal delivery of care modalities for the elderly, the fastest growing segment of industrialized populations. Policy research could include a broad range of substantive areas, including: differential health status; oral health behavior of older persons; alternative organizational arrangements for providing dental services and other related services and ethical guidelines to be used in preventing and treating oral diseases and conditions for those age groups.

Yet another area of behavioral research particularly suitable for investigation by dental hygienists is that related to the specific delineation of practitioners' roles with respect to maintaining a therapeutic alliance between patients and practitioners. Suggested research avenues which eventually might have policy implications could include: methods for teaching oral hygiene habit behavior; effectiveness of self-help programs for the patient; relationship between dental avoidance behaviors (e.g. appointment-breaking behavior) and oral health maintenance behaviors (e.g. personal practices); relationship between oral health behaviors (e.g. toothbrushing) and non-health motives (e.g. appearance); and feasibility of involving parents effectively in oral health maintenance of their children.

To provide further guidance concerning the specific interests of the National Institute of Dental Research in the behavioral and social sciences, I refer you to a new publication, *NIDR Behavioral and Social Studies*.[7] That volume organizes the abstracts of NIDR-supported research around current research objectives for the Pain Control and Behavioral Studies Program Branch. A major purpose of this volume is to assist investigators in identifying relevant behavioral and social science research in dentistry and associated researchers, and thus to encourage oral health research which takes full advantage of prior knowledge and experience. A description of relevant research support mechanisms (e.g. research grants, new investigator awards, contracts, program projects, intramural research) is also included.

Summary

Most generally, social and behavioral research for oral health deals with the identification of those factors which may be associated with the etiology, prevention, diagnosis, treatment of each of the oral diseases and conditions, and with oral health maintenance. By this identification process, it should be possible to examine the change in these factors and in oral diseases and conditions over time and across social situations. Sequentially, this effort may serve to facilitate the conduct of intervention and evaluative research which is designed to modify mutable elements for the purpose of enhancing health outcomes.

My own bias should be obvious by this point that the end-product of any research in this field — social or behavioral science, but certainly both together — must be to raise the level of oral health. The ultimate criterion for measuring effect must be on the consumer — not on any unit of analysis intermediate such as on the dental or auxiliary student, dental faculty, dental or auxiliary schools, dental clinicians of all types, but on those individuals whose oral health is the target goal for the health professions. That is not to say that studies of the student, faculty, schools or clinicians should not be done but rather that results from those research efforts should be ultimately evaluated in terms of impact on the public's oral health. And while I see personally that moving the emphasis onto the public is the major contribution so far that social and behavioral scientists have brought to the dental field, I also feel that the job cannot be successfully accomplished in any one place in the world or by social or behavioral researchers alone.

While I have said this before in other contexts, I wish to reiterate my personal belief in the necessary alliance of behavioral and social researcher with dental researcher. This alliance — perhaps as co-investigators of equal status — suggests the possibility of posing useful research questions which can have just as much theoretical value as utilitarian value. While multidisciplinary efforts are not new and are not free of logistic problems, efforts where all partners think through the problem definition and operational design for testing are still rare occurrences. The great bulk of published behavioral and social research in dentistry reflects the fact that scientists continue to work alone using on occasion consultants from other disciplines. Somehow the lack of equilibrium in project conceptualization and management appears to result in outcomes which either have meaning for one discipline or the other but rarely are conceptualized and consequently disseminated by both. The collaborative research mode is not an easy one, but I would wager that it is personally rewarding and potentially a way to maximize the future direction of behavioral and social research for oral health.

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ORAL HEALTH RESEARCH AND THE ELDERLY

Sheryl J. Feller

Introduction

Canada's population is growing older. Canadians age 65 and over now form a larger proportion of the total population than they ever have before. In 1901, only 5.0 per cent of our population fell into the 65 plus age category. By 1976, this proportion had risen to 8.7 per cent, and by 2001, between 11 and 13 per cent of our citizens will be classified as senior citizens. In the 21st century, the growth accelerates as the six million "baby boom" babies born between 1946 and 1961 approach retirement age. By 2031, if present fertility trends continue, 22.2 per cent of this country's population will be over age 65.[1]

To say that the implications of these Statistics Canada projections are significant and far-reaching is almost a cliché. However, there is almost no other statement that effectively summarizes the situation. As Canadians approach "collective old age", economic and social planning will focus more closely on the needs of an aging society. Research to define these needs is essential if the planning efforts are to be effective. Research into matters and conditions affecting the elderly is important not only to planning for the future but to improving the quality of life for those who are seniors today. For most individuals approaching old age, two concerns are prominent: maintaining their health and having an adequate income during their retirement years. We need to know more about every aspect of growing older in Canada but research dealing with health and welfare issues is a top priority. Thus, health professionals, including dental health professionals, are destined to be leaders in research on aging.

This paper will develop five themes important to those of us who have an interest in or who plan to work in this area: dental health as a health concern of the elderly; research needs with respect to aging and dental health; dental hygiene's role in this research; the process of developing appropriate research questions related to aging and dental health; and a review of some of the resources that are available to those working in this area. These themes were selected to provide an introduction to this research area and to reflect the conference objectives.

Dental Health as a Health Concern of the Elderly

Canada's elderly have significant dental needs. Caries incidence shows one of three lifetime peaks at ages 55-65 (others are ages 4-8 and 10-18),[2] periodontal disease is often severe, risk of oral cancer is high, and denture problems abound. However, we often find an inappropriate and exclusive focus on denture problems. As more seniors retain their own teeth, other types of treatment needs become increasingly important. Further, everyone — young, old or in-between, needs to learn about oral cancer and the importance of early detection of lesions.

Dental problems can have a major negative impact on an individual's ability to obtain adequate nutrition. The relationship between nutritional status and dental health status is well-known to us all and is a major reason for being concerned about the dental health needs of the elderly.

Although Canada's elderly have extensive dental care needs, many do not seek or obtain the care they require. The Health and Welfare Canada report on the health of Canadians indicated that 77.3 per cent of males and females over age 65 had not visited a dentist during the last 12 months of 1978-79.[3]

There are a number of barriers that prevent seniors from securing dental care. Restricted incomes (combined with the high cost of dental services), difficulty in reaching facilities where dental treatment is provided, fear of pain or discomfort and lack of specific advice about individual problems are only a few of these barriers.

Health and Welfare Canada, in the report of the Working Group on Preventive Dental Services, recommends that:

> Preventive programs for individuals should be based on the assessment of risk to each dental disease, with age being an important variable related to disease type and patient susceptibility.[4]

This recommendation is additional evidence indicating that dental health is an important health concern of the elderly and that efforts directed at improving the oral health of Canada's fastest growing population group are of value.

Research Needs

The National Advisory Council on Aging recommends that:

> Strong policy and financial support be directed to basic and applied research, in order for research scientists to work in the field dealing with the aging process, age-related diseases and disabling conditions.[5]

Dental health professionals need to look closely at age-related dental diseases and at the dental health needs and wants of seniors. Traditionally, most researchers have focused upon the first of these areas with epidemiological and clinical studies. Yet, even with respect to these types of studies there are only a few with comprehensive Canadian data. So many times in reviewing this area, I have encountered phrases like "there is a lack of Canadian data" or "no Canadian data exist". We can only hope that these phrases will gradually disappear as more major research studies and projects in this area are funded and executed.

There has been little consumer research in dentistry. Over the last few years, we have started to see references to "marketing", to "consumers" and to "clients" (rather than patients) in the dental literature. This client-centred focus that is starting to emerge will be a tremendous step forward for both the professionals providing dental care and for the individuals whom they serve. Consumer views of their own needs, wants, and desires provide service-providers with dramatic new insights into how to better serve their clients.

Business has long recognized the importance of consumer research and has also recognized the significance of "the maturing of the market place". A 1982 headline in *Marketing News* proclaims: "Research suggests nine rules for advertising to the elderly."[6] Consumer research with respect to dental health habits, attitudes and preferences of the elderly will contribute information which will enable professionals to alter and improve clinical procedures, aid in the development of "new and improved" home care products, and help in identifying and exploring alternatives for health care delivery systems that consider the unique financial, physical and emotional situations in which seniors find themselves.

Research can be "pure" or it can be a component of service programs. Both types of research can contribute to the field of geriatric dentistry. In a recent editorial, Lightman stated: "It is high time we stopped doing studies and surveys. We have to go into the nursing homes, old folks homes, chronic hospitals and other extended care facilities and get to work."[7] Although I agree with Lightman on the point that treatment needs are acute and that these needs should be met as soon as possible (and for the well-elderly as well as the institutionalized to whom he refers), I do not believe that we can or should stop doing studies and surveys. We do not know nearly enough yet! However, we can perform some of these studies in conjunction with the provision of services. Through our screening forms, we can access data about seniors' dental histories. Through our charts and examinations, we can obtain clinical data, and by talking to our patients, we can obtain opinions on specific issues or questions. By ensuring that every service program we develop has a comprehensive evaluation mechanism, we will reap multiple benefits. Clients will be

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better served because of the explicit focus on program effectiveness and program administrators will have constructive feedback (research data) to use in improving current services or developing new ones.

Everyone in practice, public or private, has tremendous research opportunities. Now is the time to exploit them.

Dental Hygiene's Role in Research on Aging

Quoting once again from Lightman's editorial, he says "Our greatest ally is the dental hygienist. . . ."[7]

Dental hygienists can play an extremely important role, not only in providing services to the elderly, but in conducting the research that is so badly needed. Hygienists in education, in public health, and in private practice all have unique opportunities for conducting research. This conference will help us to recognize and act upon these opportunities.

Dental hygienists can assume either leadership or supportive roles in research. Each individual's profes.ional work setting, educational background, personal interests and aptitudes will determine the specific role that she or he can assume in research endeavours.

The next portions of my presentation are directed to those of you who wish to assume a leadership role in conducting research in geriatric dentistry. First, let us examine the process of generating research questions.

Generating Research Questions

There are a number of ways to generate research questions. A question can arise from a personal experience, from a clinical observation, from a brainstorming session or while developing a theory or policy statement. Both convergent and divergent thinking play a role at this stage of the research process. As Darby and Bowen stated,

> Whatever sparks your curiosity or raises an unanswered or doubtful question can be refined and formulated into a research problem for the purpose of applying the scientific method.[8]

To generate research questions regarding dental health and aging, you might want to move from the general to the specific by using a categorizing process. This type of iterative process will help you find research questions that are not only of interest and import but which will be feasible for you to pursue. Feasibility is an important criterion in choosing a research question. The question you choose must not have time, money or manpower requirements that exceed your resource capabilities. By starting with general categories (for example, epidemiology of dental disease, socioeconomic characteristics, dental health habits, barriers to obtaining dental care), then developing more specific subtopics for each general category and continuing this refinement process, you can gradually move from general areas of interest to a specific, feasible, researchable question.

You will also use divergent thinking to generate research questions. For example, a single clinical observation might trigger your imagination and lead you to formulate a hypothesis about the cause or pattern of the condition and a way to test this hypothesis.

When you have identified a specific research topic, you will then need to translate the idea into objectively measurable terms and develop a research proposal. In order to develop a comprehensive proposal, you need as much information as you can gather about the topic. Locating and fully utilizing available resources is critical to a good research endeavour. There are a number of resources available to those wishing to pursue questions relating to the aging process. By identifying some of the resources available here in Manitoba, I hope to give you an overview of the types of support that you can find here and in other communities.

Resources

Libraries will generally be the first stop in your search for information on a particular topic. The University of Manitoba has an excellent dental library and the staff there will provide you with assistance in conducting either a manual or computerized literature search. For many topics, you should extend your literature search to other health professions such as medicine and nursing. Searching the library collections of other faculties, government health departments, health institutions and professional associations is often very fruitful.

Community agencies such as Winnipeg's Age and Opportunity Centre will be very helpful and can provide practical, grass-roots information about working with and providing services for senior citizens.

Universities can provide resource people as well as literature. Health science faculties can direct you to their staff members who are working in gerontology. The University of Manitoba has an exciting new resource for all those interested in the topic of aging. This is the Centre on Aging, established this spring and operating under the direction of Dr. Neena Chappell. One of the Centre's goals is to become a focus for scholarly research into aging at the university. In addition, the Centre will be an interface between the university and community agencies. The Centre will emphasize three research themes: health and health care, methodology and ethno-cultural studies. Dr. Chappell would be very pleased to hear from any of you interested in research on aging because she believes "that ideas for research must arise from the problems and concerns of those actually working for and with the aging"[9] and because she wants the Centre to play a major role in coordinating this research.

All levels of government can provide assistance. Manitoba government and private agencies have been leaders in research on aging. The 1955 study "Aging in Manitoba" was the first comprehensive study on the needs and conditions of the elderly conducted in Canada. Ms. Betty Havens, Director of Research for the Manitoba Department of Health and Social Development, is a widely recognized gerontological expert and would be an excellent contact for any Canadian working in the field.

By contacting universities, government health departments, selected community agencies and professional associations, you will soon acquire the support and assistance needed to develop your proposal and begin your quest for funding.

Conclusion

This overview of the research implications of an aging population has been presented with the hope of stimulating and encouraging dental hygienists to pursue research questions in this field. I look forward to sharing ideas, concerns and questions.

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RESEARCH IN DENTAL MANPOWER

Don W. Lewis

The Scope of Dental Manpower Research

Dental manpower research is not simply concerned with head counts of the number of dentists and dental auxiliaries living in a given region, nor even with these numbers expressed as a function of the region's population size such as the population per dentist or per hygienist ratio. It is much broader in scope than this and includes economic and delivery considerations, topics which have been assigned to others on this panel. But there are many other interrelated factors involved. Therefore, to put dental manpower research in proper perspective, it is best to start by reviewing a conceptual, descriptive model of the whole dental care system. After this, I shall identify some problems inherent in dental manpower research and some areas where research is required under present practice conditions in Canada. I shall try to stay clear of economic and dental delivery issues (although I may cheat a bit since there is so much overlap).

The best conceptual model to guide our thinking is represented by an econometric supply-demand model of the dental care system. This model is presented merely to give some idea of the broad scope and high interrelationships of the factors potentially affecting dental manpower (and therefore amenable to manpower research) and not because I believe the dental care market is a classic economic market. The available time constraints will mean that this description is brief and basic. Essentially, one must consider all of the factors influencing the supply of dental care services, on the one hand, and all of the factors influencing the public's demand for dental care, on the other. It is important to note that the goal of the system is optimal oral health status of the public and not the gratification or perpetuation of any of the present dental provider groups. Ideally one would hope that, in the achievement of this goal, the required preventive and therapeutic services would be rendered in the most effective and efficient manner possible. I am painfully aware that the ideal is seldom reached and that the clinic or professional model described here has been heavily criticized by some for its lack of effectiveness and efficiency and of consideration of the many externalities that can affect oral health. But as just mentioned, I am talking here about needed research under the present delivery system, warts and all.

Now a few comments about *supply* which I referred to very purposefully as being dental services and not numbers of dental personnel. It is the amount and types of services produced by these personnel working alone or in various combinations and in a variety of settings that count. And, in all these comments, it is assumed that the dental services provided reach some realistic level of quality. What are the non-demand factors that may affect the amount, type and quality of services? Some that might be considered are: the numbers and types of dental personnel, their geographic location, longevity in the workforce, hours worked, and practice arrangements; the number, type, standards and location of dental educational institutions and their admission procedures; the regulations governing dentistry; the influence of the dental supply, equipment and service industries; and the income potential and reimbursement arrangements of the dental care providers. Even with this limited list of supply side factors of our model it should be clear that all these factors are intimately interrelated and that dental hygiene has an interest in each factor. To the extent that the provincial regulations governing dental hygienists affect the amount, type, quality and distribution of dental hygiene services in Canada, the study of these regulations and their impact can be considered as dental manpower research. These pervasive manpower issues are familiarly described in the hygiene literature as: poor delegation/low utilization; the need for and type of supervision; lack of national standards and portability; and variations in the permissible range of duties.

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The public's *demand* for dental care must also be considered as a major component of the dental care system. Demand is also an important dental manpower concern in the sense that the supply of dental services just mentioned is utilized by patients to achieve or maintain good oral health and/or freedom from pain and/or improved chewing and/or better aesthetics. (Most patients, I believe, demand these latter things; the services are merely the normative, professionally-defined means to these ends, although there is not universal agreement that this is the best or the only way to achieve these ends.) The predisposing and enabling demand factors would include all those things that enhance or discourage dental attendance. Some such factors are: social and cultural status; the direct (fees) and indirect (travel and waiting time) costs of care; the impact of third party plans; self-perception of oral health status; fear; availability and accessibility; and possibly, if medical care provides us with any lessons, the influence of the dental providers themselves or so-called supply-induced demand. The interdependence of many of these "demand" factors is also apparent. As well, their combined effect on actual utilization (effective demand) is probably influenced by the true state of oral health which, in turn, is partly affected by environmental considerations such as the presence or absence of water fluoridation.

Complications and Problems

Even though all of the demand-supply factors and their interrelationships are not completely understood, whatever interaction between demand and supply that does occur in the dental marketplace to affect oral health status for the better is obviously very complex. Incidentally, several large computer econometric and "systems" models, which take into account some of these factors have been developed to study dental manpower. Although the ultimate dental manpower research would require the use of even more comprehensive computer models than those currently available, I am not suggesting that your manpower research has to be this sophisticated. However, I do believe strongly that dental manpower researchers should be cognizant of the existence and interdependence of all these complex factors. Manpower research should not be conducted in isolation, or in ignorance of this wider understanding about the dental care system. Using the demand-supply conceptualization or systems approach I have outlined may seem very theoretical and abstract and, indeed, it is. However, it does force one to consider the scope and complexity of any manpower research undertaking and, therefore, may improve research design and enhance subsequent implementation of positive research findings.

While on the topic of complexities, another problem of dental manpower research (particularly with the more issue-oriented hygiene manpower research) which must be mentioned here is politics, to use a single word. I would like to develop my point here by quoting extensively from Born[1] who in the introduction to a recent commentary about forecasts for dental specialists in the United States, said some things that are very relevant to various aspects of dental hygiene manpower research and the implementation of these research findings (just read "dental hygienists" for "dental specialists" and "provincial" for "federal"):

> This is indeed a complicated game we seek to play. The stakes involve the collective health of the public, future dental incomes, untold tax dollars, the livelihood of several thousand dental educators and the lives of our future dental specialists, who may or may not be able to earn the level of income they anticipated when starting their careers.
>
> The players are dozens of training program administrators, federal bureaucrats with their funding powers, organized professionals, and perhaps, with little more than a cry from the wilderness, the consumer.

> We are told the name of the game is "forecasting manpower requirements", but the real game comes closer to political one-upmanship. The struggle is to see whose forecasts can be most forcefully presented to the key decision-makers. It seems simple enough once we have a handle on this truth, but then we realize there isn't really a corporate decision-making body. Instead, there's a diffused network of boards of higher education, admissions and accrediting committees, deans, program heads, specialty associations and boards, and a hodgepodge of other gatekeepers who may or may not respond to reason, argument, statistical forecasts, or federal dollars. They are a contrary lot; each one has a unique set of biases, beliefs and hunches about what's best for (1) dentistry, (2) the public, and (3) his or her future.
>
> Once we get past realizing what the game is all about and have identified most of the players, we turn to the forecasting methods themselves. There we discover an enormous number of variables which can affect either supply or requirements, or both. The potential combinations of those variables are mind-boggling.
>
> To top it all off, we find there are not fixed rules for the game; only history can determine the winner and by that time, most of the players will have gone home.[1]

There are some valuable but frightening lessons in Born's words. I've recently experienced some of the problems he describes in a large three-and-one-half year, dental manpower study in Ontario that cost the taxpayers about $300,000. Although I have absolutely no intention of dampening your spirits for manpower research, it would be irresponsible of me not to emphasize the difficulties in the environment surrounding dental hygiene practice so that you will, perhaps, be better prepared than I was if you become engaged in a sensitive manpower research project. Note also Born's inference that it's not always the other person who is self-serving; no one is immune, not even dental hygienists.

Needed Dental Manpower Research Areas

Having expressed, and indeed perhaps overstated, my concerns at some length, I shall now outline in a general way some of the areas of needed dental manpower research which may be of particular interest to dental hygiene. Note that it would be inconsistent with the required broad conceptual approach just outlined and the need for multi-disciplinary efforts to allocate one segment of manpower research to dental hygienists or any other provider group alone. However, it seems to me that to define a particular interest area does no harm. There is no priority order to the following list, nor are many details provided. My intent is to generate ideas for you to choose and develop as future research endeavours.

1. ***Supervision*** — a thorny issue which as Nagle[2] has pointed out editorially requires research rather than argument. Some research questions/issues follow:
   a. What are the fundamental issues in supervision, including harmful patient outcomes and dental care costs?
   b. Do present supervisory regulations act as unnecessary barriers to the receipt of more dental care by more people?
   c. What differences in tasks performed, patient costs, hygienist utilization, patients' oral health and satisfaction exist between those two provinces which allow some indirect supervision (by prescription?) and the remainder which do not?
2. ***National Standards/Portability*** — an "integrative research review" is needed and is apparently under way by the CDHA Portability Task Force.
3. ***Range of Duties/Tasks*** — Miller[3] is currently compiling lists of the different permissible tasks in each province for CDHA; however, other questions remain.
   a. What differential effects do present provincial variations in allowable tasks for dental hygienists have on patients' oral health?
   b. Research into weighted indices of dental task performance is needed. Marcus and Drabek[4] have done some work in measuring dental tasks in a study of dental manpower requirements but more developmental research work is needed.
   c. Functional task analysis studies of current patients' and anticipated future patients' dental needs in view of probable demographic and oral health status changes are needed to identify the optimum personnel or combinations of personnel required.
4. ***Delegation to and Utilization of Dental Hygienists***
   a. Do valid and reliable indices of delegation exist? Very little work has been done. The Marcus *et al*[5] DID index is the major exception.
   b. State of the art on barriers to delegation using the integrative research review approach would be helpful.
   c. Documentation of the extent and regularity of performance of expanded functions and evaluation of reasons for differences between high and low experience are needed.
   d. What are the economic benefits (for whom) of greater delegation?
   e. What are the characteristics of high versus low "delegators" (dentists) and, in the same practices, "delegatees" (dental hygienists) and what interactions exist between dentist and hygienist in this regard?
   f. What is the utilization experience of dental nurse/therapists in *private* practice in Manitoba and Saskatchewan?
5. ***Behavioral and Quality Issues***
   a. Attitudes of dentists, auxiliaries and patients to greater utilization/delegation studied jointly using the practice as the unit of analysis may give some greater practical insights. (Research to date has focused on each group separately.)
   b. What are the contrasting characteristics, of "productive" versus "non-productive" dental teams?
   c. Is there any relationship between the communication ability of each dental provider in private practice and patients' perceptions of quality/satisfaction with the care rendered? (The limited research to date has been done in dental schools.)
   d. Development of, and surveys with, valid and reliable measures of patient satisfaction with dental and dental hygiene care.
   e. More documentation and descriptive analysis of career satisfaction of dental hygienists.
   f. Although there have probably been sufficient studies documenting the lack of differences between dentists and dental hygienists in expanded duty areas, objective comparisons of quality for more traditional procedures have not been done nor are the evaluative scoring methods for such procedures well developed.
6. ***Supply and Distribution of Dental Services***
   a. Activity and working life of dental hygienists has recently been well documented in Canada and the U.S.A. To the extent that misconceptions about the ultra-short working life, high part-time, very mobile and many-positioned dental hygienist persist, more local research on this or promotion of that already done may be necessary.
   b. Indices describing aggregate working life or activity are not well developed.
   c. Ongoing documentation of the regional distribution of dental hygienists using an aggregate activity index (not head counts of licensees) would be useful, especially if analyses of the reasons for shifts over time were included.
   d. What is an adequate supply of dentists, dental hygienists, denture therapists/mechanics and other dental auxiliaries? Should need, demand, social target-setting, patient satisfaction or some other measure be used to decide what is an adequate supply? Whose perspective should guide this choice?
   e. What key factors influence the distribution of dental hygienists within a province?
   f. What are the implications of the enrolment and other policies of institutions educating dental hygienists for the future supply and distribution of dental hygiene services?
7. ***Productivity/Efficiency***
   a. Better measures of dental productivity are needed, including the possibility of builtin weightings for the complexity/skill required and efficiency aspects.

b. Nearly all of the dental productivity experimentation with different staff, auxiliary duty and equipment mixes has been done in public practice settings (and in computer simulations), not in private practice; therefore optimum arrangements in private practice are not well researched.

c. What relationships exist between different levels of productivity and broadly defined measures of quality of dental care?

d. What influence on productivity, efficiency and quality of care does the full-time use of a chairside assistant by a dental hygienist have?

e. A number of production functions have been developed for dentists relating different factors of production (e.g. dentist age, equipment, number and type of auxiliaries) to practice productivity (e.g. visits, or services or gross dollars). Are such production functions feasible for typical private dental hygiene practices and, if so, are the necessary data available or do they need to be gathered?

8. **Demand for Dental Care**

a. What are the implications of the changing demographic structure and oral health status of Canadians for potential future demands for dental hygienists' services?

b. What is the (likely) influence of private and public dental "insurance" on demands (future) for dental hygienists' services? And what is the service experience of third party plans covering traditional dental hygiene services today?

c. What are the implications on future demands for dental care by the public of institutional advertising or of greater "in-office" promotion and advertising?

9. **Cost of Care, Dental Hygienists' Compensation and Fringe Benefits**

These are blatantly economic areas and I have already encroached too much on this area and dental delivery. But these have definite manpower implications.

In summary, I've described the broad scope and mandate of dental manpower research and the complications and problems attending this research under the existing hierarchial organization and regulation of dental care. I've outlined by questions and comment a number of areas of varying importance, sensitivity and complexity where research is needed. These areas require a variety of research designs and techniques. All this is based on the premise that greater knowledge arising from soundly derived research findings will lead, rationally, to the necessary policy change(s). This premise is naive for any number of human affairs and for many aspects of dental manpower too; Born[1] has nicely outlined some of the reasons for this. Well, where does that leave the researcher, besides uninspired? I feel that despite the system and its potential for irrationality and political decisions, it's the role of the health services and policy researcher — that's the animal we're talking about here — to provide valid and reliable data based on good, objective study methods and hypotheses. If the politicians, at all levels, make bad or no decisions, then that's their problem. And just think, occasionally the right decision might be made!

Another research area which I increasingly feel is extremely important is to understand how things tick; that is, how change comes about. We are, I think, very weak in this research area, described by some as diffusion research. Clearly diffusion research leading to effective implementation strategies should either precede or accompany some of the manpower research I've suggested. But we'll leave that for another conference.

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RESEARCH IN DENTAL CARE ECONOMICS

John M. Horne

The topic, research in dental care economics, requires considerable refinement if I am not to exceed the 15 minutes at my disposal. Accordingly I will not attempt a "state of the art" assessment, nor will I venture into associated matters of methodology and research design. My more limited intent is to identify some economic aspects of dental care delivery and finance which, notwithstanding previous research, remain good candidates for further investigation.

At the outset, it is well to emphasize that there are some topics where further study would, in my view, constitute a misallocation of scarce research resources. I'm thinking in particular of research on the use of auxiliaries in private practice and allied investigations into the scope for delegation of various tasks and clinical functions from dentists to "expanded duty" auxiliaries. As you are no doubt aware, numerous studies have demonstrated that it is technically feasible to train dental hygienists and other auxiliaries to perform a variety of restorative care functions at levels of clinical competence equal to, or even greater than, those of the dentist. Equally favorable outcomes have been demonstrated in respect of patient satisfaction with care provided by auxiliaries. These findings, coupled with the fact that dental auxiliaries command incomes substantially lower than those of dentists, clearly indicate that the costs of dental care could be reduced without adverse quality effects by expanding the employment of dental auxiliaries in settings and circumstances where the dollar savings accrue not to the private dentist but to society as a whole. To be sure, the evidence on technical efficiency and cost-effectiveness of expanded duty auxiliaries is clearest in the case of children's dentistry where various public programs have been systematically evaluated, but even in the case of adult dentistry there remains little doubt that greater substitution of low-cost for high-cost personnel is both technically feasible and consistent with prevailing standards of "good" dental care. Indeed, such major ambiguities as remain relate almost entirely to why the existing system of fee for service private practice seems inherently incapable of exploiting the full potential for "low-cost" dentistry, and whether, in consequence, corrective public policies should emphasize greater competition among private practices or, alternatively, an expanded role for government as direct provider of care.

Fluoridation of public water supplies provides another example where efficacy and cost effectiveness have been well established in previous research. Indeed, it has been conventional wisdom for some years that such programs represent the single most cost-effective strategy in preventive dental care. What defies comprehension and what should be the basis for further research is why many large Canadian cities such as Vancouver, Victoria, Regina, Calgary and Montreal have not yet implemented fluoridation programs. That such seemingly heterogenous communities have opted to make the same mistake is surely something that warrants further research. If as seems likely, the principal obstacles to fluoridation are less economic than they are social and psychological, such research might well yield results of major practical value to dental health educators and other practitioners of community dentistry.

Other empirical questions in dental care delivery and finance on which health economists must confess to considerable ignorance are embarrassingly numerous. The imbalance between questions and answers is amply illustrated in the case of three relatively recent developments in the Canadian dental system. These are: 1) the rapid growth in third party dental insurance; 2) the rapid growth in system-wide capacity brought about by unprecedented increases in the numbers of dental personnel, especially dentists and dental hygienists; and 3) the proliferation of dental hygiene education programs in community college settings. Each of these developments raise questions that to my knowledge have not yet been resolved and, in the time remaining, I would like to explore briefly these questions and thereby suggest avenues for future research.

The growth of third party dental payment plans is a well advertised and documented phenomena. Published data show that over the period 1970 to 1978, the proportion of the Canadian population covered by such plans increased from next to nothing (1.75 per cent) to approximately 28 per cent.[1] Other more recent reports suggest the current figure may well be as high as 50 per cent. Sponsored mainly by firms and agencies operating within the private sector, these plans have obviously served to reduce the direct financial barriers to care for a large number of Canadians. It remains to be determined, however, whether and to what extent such plans have increased the willingness of individuals to seek dental care. Moreover, we do not know whether these plans have induced dentists to recommend and provide more frequent care and more elaborate treatment of their insured patients. Such evidence as we have suggests the plans have had very little impact on overall utilization when measured by the per cent of population who visit a dentist at least once a year. Thus, in 1970-72, 49.5 per cent of respondents to the Nutrition Canada Survey reported seeing a dentist in the previous 12 months;[2] in 1978-79, the corresponding figure, based on the Canada Health Survey, was only marginally higher at 50.3 per cent.[3] The principal utilization response to third party payment apparently has taken the form of increased service use among individuals who were regular seekers of care prior to becoming insured. In part, this may reflect the fact that insurance coverage is still relatively rare among low income families whose survey data reveal to be among the lowest users of dental services. In a 1978 survey conducted by Statistics Canada, it was found that only 20 per cent of low income persons made any expenditures on dental care, compared with 74 per cent of high income families.[4] Further confirmation of such differential utilization effects in carefully designed research might diminish some of the current enthusiasm for conventional employer/employee plans as the best means to achieve further improvements in access to services. It should also spur further efforts to determine whether those whose utilization has been increased by insurance have experienced significant improvements in dental health status. Finally, the availability of more accurate estimates of the effect of insurance on dental utilization would reduce speculation about the likely costs of alternative public programs that would "pay the bills" for some or all of the adult population.

The second development — an unprecedented expansion in the number of licensed dentists and dental hygienists over the last decade — has clearly enhanced the capacity of the system to produce and deliver both restorative and preventive services. Thus, aggregate national data indicate that the number of persons per licensed dentist decreased from 2913 in 1971 to an estimated 2082 in 1981[5], a rate of change much faster than that which occurred over the previous decade and a dramatic reversal of the trend toward higher and higher ratios (fewer and fewer dentists per capita) which dominated the 30-year period prior to 1961. The numbers are even more impressive in the case of dental hygienists. In 1971 there were only 849 licensed hygienists in all of Canada for a ratio of one hygienist per 25 571 persons; by 1980, the number had grown to 3924, a four and one-half fold increase yielding a ratio of 1 hygienist per 6139 persons.[5]

Interestingly, downward movements in these ratios are commonly termed "improvements" on the implicit assumption that the public always and necessarily benefits from an expanded supply of dental personnel (and symmetrically, always and necessarily loses when the supply of dental personnel is reduced). In fact, however, we know very little about the nature and extent of the benefits which occur in such circumstances. Thus, there is no good Canadian evidence showing a strong positive correlation between dental health status on the one hand

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and the availability of dental manpower on the other. The Canadian Dental Association recently noted that the available evidence simply suggests that favorable levels of dental health may be achieved by a *combination* of an above average supply of private dental practitioners; an active dental public health program emphasizing education, prevention, and referral; and, as well, water fluoridation.[1] By implication, it would take carefully designed research to factor out the independent effects of manpower, education, and fluoridation on dental health.

Benefits from an expanded supply of dental personnel may also be defined in terms of improved geographic access to services. Viewed in this dimension, a relevant research question becomes "do major increases in the supplies of dental personnel alleviate maldistribution problems across provinces or across urban and rural communities within provinces?" Since all we now have is anecdotal evidence that "more" dentists are locating in smaller communities, there is a clear case for more systematic research on practice choices, including some comprehensive prospective cohort studies of graduating dentists and dental hygienists. Meanwhile, the issue remains unresolved and those policy-makers concerned with the dental manpower question have little reason to be sanguine about present trends, not least because there is evidence that a similar rapid expansion in the stock of medical manpower has done little to alleviate historical problems of geographic access to medical care. An allied question which invites closer examination is whether the more direct efforts that have been made to affect location choices of private practitioners have had the intended effect. I'm thinking here of the various incentive programs that have been selectively developed to attract practitioners to certain designated "under-serviced" areas in rural and isolated communities. Testimonials from interested administrators that these programs are "successful" are obviously no substitute for carefully conducted program evaluations in which efforts are made to enumerate and quantify all the relevant costs and benefits.

Another avenue of investigation that would further clarify whether "benefits" do indeed accrue to the public from an increased supply of dental personnel would focus on dental fees. Here the demonstration of benefits would require evidence that fees are relatively low in areas where practitioners are relatively abundant. Since we all know that dentists do not ordinarily compete for patients on the basis of price (and indeed are collectively opposed to such conduct), evidence of fee discounting in markets "saturated" by private practices would be as surprising as it would be difficult to obtain.

You may be somewhat surprised that I have identified the proliferation of dental hygiene education programs in community colleges as one of those developments in the Canadian dental system about which our curiosity exceeds our comprehension. I should therefore explain that I was influenced by three considerations. First, I wanted to dispel any impression that I was incapable of identifying opportunities for research in areas relevant to your interest and concerns. Second, after inspecting the facts on the distribution of graduates by school of graduation, I was convinced that this was indeed a significant development. Third, after a cursory review of the literature, I was satisfied that some obvious questions had received little or no attention and that, in consequence, further research ran no risk of being redundant.

Since the facts themselves are doubtless well known to all of you, I will only provide brief review. Prior to 1975 all Canadian graduates in dental hygiene received their training in university-based programs. In 1975 almost one-half of the graduating class of 304 had received their training in community-based programs. By 1978, when the number of graduates peaked at 524, fully 80 per cent of the class had received their training in these community college programs.[5] In more recent years this figure has doubtless decreased due to enrolment reductions specific to the community college programs in Ontario and Quebec. It is clear, however, that we continue to rely on two quite distinct institutional models of dental hygiene education. In such quasi-experimental circumstances there is an obvious opportunity for meaningful, policy-oriented research. Thus, programs representative of their respective models could be evaluated on the basis of some quite explicit measures of program quality (structure, process, and outcome) which, together with some suitably detailed analyses of program cost, would permit assessments of relative cost-effectiveness. Almost by definition, evaluation research of this sort tends to be threatening to those who have direct administrative responibility for such programs. I don't deny therefore that there may be problems in securing the requisite cooperation to launch such a project. These and related issues might well be the basis for an interesting debate in the group discussions.

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RESEARCH ON DENTAL CARE DELIVERY FOR DENTAL HYGIENISTS

David G. Fish

Introduction

I would like to deal first with the question "why should dental hygienists be involved in research on the provision of health care?" Health professionals whether engaged in education, practice or administration, have a considerable stake in the problems of providing dental health care. Practising dental hygienists have a professional commitment to provide optimal care both to their patients as individuals and to the population, whether that population be of Winnipeg, Manitoba, or Canada. Those engaged in teaching will be committed to training hygienists to a high standard, both technically and in professional attitudes. Hygienists involved in policy making and administration will want to see programs initiated to meet the needs of our society.

Yet I am equally sure that all are aware of problems that are present in achieving those objectives. Practising hygienists will be aware that not all patients comply with instructions to brush and floss nor even with persistent recall attempts. They will recognize as well that the patients seen are not representative of the population — patients that find their way into a private practice or seek dental help from specialized facilities such as dental school clinics have different characteristics than those that seek no care at all or seek help only when an emergency arises.

Those engaged in training activities will be aware of the limitations both of the students and of the program. If the experience is similar to that of medical schools, dental hygiene educators will know that in every graduating class there are graduates who do not meet technical or professional standards, but the system does not permit an easy rejection.

Administrators and policy makers, too, will find that, in addition to fiscal restraints, the introduction of innovative policies and programs is inhibited by rigidities that are already built into the system. The entrenched rights and responsibilities of all health professions have created significant barriers to change.

In this imperfect system of dental care and professional education, therefore, we are all well aware that while every member of the population may be considered to have the right to optimal dental care, we can safely make the categorical statement that only a small percentage of the population at present receives such care.

This leads to the question regarding the responsibility that dental hygienists can exercise in tackling problems in the dental health care system. From my perspective, every professional has such a responsibility and this responsibility can be reflected in a number of ways. Certainly, there are the practical ways of improving the system. Innovative interventions such as community health clinics can be stimulated or initiated by the professionals themselves. Professor Horne's concept of "fast food removal services" may prove to be a valuable addition to our dental health care facilities. In the academic setting, research is a primary function and in any professional school, there should be a research thrust in the area of the provision of health care. Departments such as my own, and Departments of Preventive Dentistry have this mission.

It is appropriate, therefore, to ask "what is the nature of the problems that are worth researching in dental health care?" I would like to divide the problems into two areas, one of which I term "microsystem" and the other related to the system at large. Under the heading of microsystem, we might deal first with issues related to the "quality of care".

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The Quality of Care

It is safe to say that not all dental care is of the same quality. Without going deeply into the debate about whether dental hygienists can "drill and fill" as well as dentists, there will be substantial agreement, particularly by those in the academic world, that not all practitioners, whether dentists or hygienists, perform to a similar level in the practice setting. People differ in their diagnostic and their technical skills. From a consumer's point of view, from the practitioner's point of view and from the educator's point of view, a vast amount of research needs to be done on the quality of care. First, though, we need to establish standards for the measurement of quality. Second, we need to know how to apply those standards with reliability and validity.

In a recent Manitoba study[1] that compared the work of private dental practitioners with work carried out by dental nurses, we found it difficult to obtain agreement among experts in the field regarding appropriate criteria to be applied in the measurement of oral hygiene in children. Further, there was not always agreement in the application of those standards that were developed for a particular child. No criticism is intended of those involved in the setting and application of the standards. In general, the strategies for developing and implementing, and monitoring quality of care evaluation in the health field are only in their developmental infancy and this applies to nursing, medicine and other health fields as well as dentistry.

Efficacy of Treatment

"Efficacy" means "does the treatment work?" It is not much use implementing a complex dental care delivery system unless the procedures and diagnostic tools are beneficial rather than harmful to the individual. In the case where a procedure or a treatment may do no good but also do no harm one can argue that the patients may perceive that the treatment has made them better. In such a case there may be some justification for it!

Dr. Jack Neilsen, former Dean of Dentistry at the University of Manitoba, likes to remind me that I once commented to him that despite the increasing technology in dental care there had been no major advances made in dental treatment or prophylaxis other than the use of a piece of string. This statement was made some ten years ago and may be seen as somewhat cynical. Nevertheless, when I learn that the dental profession is beginning to have doubts about the long-term efficacy of "caps" and "post and crown", I am reinforced in my view that the dental professional, whether dentist or dental hygienist, must be conscious of the need for constant review of the outcome of procedures.

In the field of dental hygiene I doubt that the long-term benefits of whether the teeth should be brushed once, twice, three times, four times or six times per day has been put to a rigorous controlled trial. Does floss really work and is the unwaxed better than the waxed variety? The literature abounds with case studies and clinical impressions but few "tight" controlled trials. I might question whether the vigorous cleanings by dental hygienists are, in the long term, of any benefit at all. If normal physiology builds up deposits at an increasing rate after the age of 30, one wonders why a biological mechanism to remove it was not built in at the same time. The case has been argued to me by a noted geriatrician that the deposits may in fact be protective (at least for some people) to the teeth.

Provision of Dental Services

Let us assume quality of dental care is reasonably homogeneous among those who practise the profession and that the treatments are reasonably efficacious. We then get into problems of the organization of the services and access to them. You will have already heard from Professor Horne that economics may have an influence on the provision of dental care. In particular, dental insurance schemes, whether public or private, may remove barriers to dental care. The evidence to date,

however, suggests that non-monetary factors play a significant part in the provision of dental services.

The onus is on the researcher to find out who in fact is "at risk" of not receiving optimal dental care, what factors influence participation, and whether those factors are located in the system of dental care or in the individual client or patient. I should emphasize, however, that it is equally important to ask who is receiving optimum dental care, why are they receiving optimum dental care and what are the factors that facilitate their doing so. Too often the emphasis in research is on the problems rather than on the successes.

The opportunities for research in this area are far too many to be enumerated here, but I would like to focus on two different areas that I believe are important. First, a major problem faced by those who are responsible for the oral health of the population is related to the failure of patients to come into treatment early enough or to maintain the recommended strategies of oral hygiene.

Theoretical models have been developed for explaining the compliance behaviour of patients in various therapeutic regimens including hypertension, diabetes, obesity, immunization, etc. These models are applicable to dentistry in a general sense although there may be factors associated with the maintenance of oral health that may be different from that related to physical health. The differences, however, may be qualitative rather than absolute. For example, while one may cite "fear of the needle" as one reason why patients do not seek immunization, the "fear of the dentist's chair" is probably a real deterrent to seeking dental care. We know little about the factors that lead to this fear or the characteristics of those who experience it. The literature contains a considerable amount of anecdotal and clinical evidence and a number of studies using small samples. Clearly, there is more room for research in such an area. Nevertheless, hypotheses can be advanced as the prevalence of "fear" among particular groups of people. For example, one would hypothesize that there are significant differences in terms of age. Younger age groups may be less fearful than the elderly due in a large part to improved techniques such as the use of local anaesthetics for fillings, high speed drills for fillings and perhaps greater sophistication in the art of managing the young patient in the dental office. Further, we need to know the relative contribution of "fear" as a barrier to dental care. Is it the "only" factor or is it one of many that contribute?

At the population level, there is considerable room for exploration of hypotheses related to cultural change and dental hygiene. For example, the evaluation of the Manitoba Children's Dental Plan suggested that the introduction of the plan had reduced the number of decayed teeth in those enrolled in the plan compared to those who were not.[1] At the same time, the findings also suggested that the "oral hygiene" as measured by gingivitis and dental plaque, was not significantly different from that found in 1976 or in the control groups.[1] Why should this be so when the programs, both public and private, were oriented to maintaining oral hygiene as well as filling cavities.

From my perspective, I believe that social change is required before changes can be made in daily routines, changes that require reorientation of social values in relation to oral health and the allocation of time. The oral hygiene of children depends on the values and the orientation of the parents and that until we have evolved through another generation, the oral hygiene as measured by dental plaque and gingivitis will largely remain the same. In other words, the dentists and the dental hygienists can preach the gospel of frequent tooth brushing and flossing but until the population is convinced that this gospel has validity, the oral hygiene of our children and of the adults is not likely to improve.

The Training of Dental Hygienists for Research

If we accept that dental hygienists have a responsibility to engage in research related to the provision of health care, the question concerning the need for training in research arises. I would hope that universities will encourage faculty to pursue further training in relevant disciplines and areas. In the case of health care research, I hope dental hygienists would seek training in fields such as epidemiology and sociology.

I am sure that NHRDP, the body that funded this conference, would welcome applications from dental hygienists for Fellowships for training in these disciplines.

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CONFERENCE SUMMARY

Jean-Paul Lussier

First, I express my gratefulness to this organization for the invitation to participate in this program. My credentials for being here consist more of my constant interest in the development of the profession of dental hygiene than in any specific competence in the research areas discussed. Therefore, the comments I make will reflect the interpretation of an outsider who has witnessed with satisfaction the tremendous growth of the profession of dental hygiene and the level of maturity and social responsibility it has now reached. The fact that we are participating at this conference is an example of the rapid and profound evolution.

Second, I address high praise to the deserving planners and organizers of this program, Margery Forgay and her colleagues. Their care and skill in designing the program and in selecting such a competent faculty can only be equated by the devotion they have instilled into their mandate. They must be congratulated for this very successful conference.

The purpose of this conference was to generate research ideas and directions for dental hygienists who quest for a role in research. The program, designed to meet this challenge, included presentations by essayists and panelists as well as group sessions to enable the participants to plan research strategies and establish research priorities.

After the official presentation of greetings, essayists covered general topics on the theoretical and practical basis of dental hygiene research, the ADHA research development program, and pragmatic information on research grants and granting agencies. Some of the highlights of this successful two-day conference follows.

Dr. John Stamm in his opening presentation stated that organized dental hygiene appears to be interested in research to pursue knowledge and assert itself as a true profession. He questioned if, in the pursuit of this knowledge, research could establish dental hygiene as a discipline or confirm it as an area of study. Dr. Stamm made a clear analysis of the conceptual elements which characterize a profession and used physical therapy and nursing research to exemplify two contrasting patterns of evolution. Turning to dental hygiene, he indicated that some dental hygienists are well regarded as researchers, but that the profession itself has not proclaimed research as one of its major areas of endeavour; in medicine and in dentistry this commitment has been long-standing.

To determine whether dental hygiene is a discipline with its own inherent theory or an area of study with concepts emerging from other established disciplines, he reviewed the criteria of " a genuine discipline." His criteria showed that dental hygiene and dentistry are not disciplines. Furthermore, Dr. Stamm suggested that the nursing model is unsuitable for dental hygiene research because of historical and demographical factors. Rather, he suggested that we view dental hygiene as an area of study even if this model is not entirely exempt of criticism. Dr. Stamm provided the following four strategic steps "for developing in Canadian dental hygienists a capacity for quality research": attainment of the first university degree; institutional affiliation; emphasis on personnel training ahead of research projects; and an orientation for research by dental hygienists.

Next, Professor Michele Darby presented her thesis that "dental hygiene research and theory development are essential to dental hygiene practice and professionalization." She stated that "research is the hallmark of a true profession, for it is through research that advancements and improvements in a profession's service role to the public are achieved". From this opening statement, she rigorously demonstrated that through a strong research effort, dental hygiene can effectively establish itself as a full-fledged profession. Step by step, Professor Darby explained how dental hygiene theory can be developed using, as an example, the experiments conducted at her own institution. She described the process through which research develops and expands theory. "Theory," she said, "directs research and research findings shape the development of theory".

She strongly sustained that the model already elaborated for nursing research and theory development could be applied to dental hygiene. Nursing research has grown along a dual orientation, namely the process of care and the environmental factors surrounding it. This differentiation has been at the basis of the theory of nursing and could provide a basic model for the development of dental hygiene theory. Even though contributions from other disciplines have been considerable and will continue to be so, the identification of care as a specific and definable responsibility of nursing has constituted a central and fundamental concept from which the theory of nursing has emerged. The same option could be just as salutary for the development of dental hygiene theory.

It was most interesting for the conference participants to have two different, well-documented approaches, presented side by side. It, of course, triggered a lively discussion which left opportunity for future deliberations. During the discussion, it came to mind that we could analyze the field of social work for the sake of learning more about professional maturation. Currently, social work is in a phase of intensive introspection. Monitoring its professional maturation might be helpful to dental hygiene.

We were fortunate to have Denise O'Brien review the American Dental Hygienists' Association's activities for promoting research. The ADHA Research Initiative Task Force, instrumental in advancing research in dental hygiene, recently completed a survey of dental hygiene researchers and sponsored the first dental hygiene research forum at the 1982 Annual Session of the American Dental Hygienists' Association. The ADHA accomplishments are most encouraging and Ms. O'Brien's encouragement of Canadian dental hygienists to take advantage of its experience was a gesture received with appreciation.

After these presentations, came the panel on Research in Education. This panel implied that the transfer of knowledge and development of values must remain in constant introspection and further underscored the necessity to reassess strategies used to educate dental hygiene professionals. As members of the panel, Professor Denise Bowen and Dr. Don Lewis elaborated on the general theme of dental hygiene education and identified numerous opportunities for research in this area; Denise O'Brien addressed researchable problems in the area of continuing education.

According to Professor Bowen, some priority areas in need of research are curriculum overcrowding, clinical teaching and evaluation methods, admissions criteria, predictors of future performance in dental hygiene, and the issues of manpower as related to education.

Dr. Lewis astutely emphasizes that many of the issues raised at the 1974 Canadian Dental Association's Conference on Dental Auxiliaries such as staffing, recruitment, lack of national standards for dental auxiliaries, inappropriate utilization, inadequate task delegation, the matter of supervision and the COP system still need to be addressed.

Denise O'Brien suggested that the issue of continuing education presents the same common problems to all professions as they quest for a model that will guarantee professional competence. Expectations from continuing education are great, but the results are unconvincing. For example, since continuing education became mandatory in several constituencies, idiopathic difficulties have arisen which have further complicated the issue. Ms. O'Brien suggested the need for behavioral research on motivation to participate in continuing education and the need to measure the impact of continuing education on services and the quality of patient care.

The second panel addressed Research on Dental Disease Prevention. According to Alice Horowitz, whose paper was delivered by

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Joanne Clovis, fluoride research should be attractive for dental hygienists particularly in the clinical and technology transfer areas. In spite of the progress made in laboratory research, the two areas mentioned need to be investigated further.

From the clinical perspective, fluoride research must be conducted on adults and the elderly; follow-up research on children also must continue to determine if the effects produced by fluoride are really preventive in nature or simply a matter of delay. Canada ia a good place to conduct this type of research. Other researchable areas included the evaluation of various combinations of fluoride procedures applied simultaneously; measurement of the acceptance of fluoride use; and involvement of other health professions and their influence on the use of fluoride products and methods.

Dr. John Stamm limited himself to prenatal fluorides, a much narrower subject but well suited for the topic of the panel. Dr. Stamm outlined a hypothetical schematic plan to test factual data. Using two different sets of results, he demonstrated the process used to discriminate between quality and weak research. With another set of data, he provided an exercise for interpretation.

After two panel discussions, the conference participants were divided into small groups to discuss the implications of the presentations and panels heard. The reports of the group sessions indicated that on the topic of educational research, the following research priorities surfaced:

1. the relation between dental hygienists and their level of education; utilization and scope of practice.
2. supervision: its extent and effect on job performance and job satisfaction;
3. curriculum content and its relationship to job performance;
4. peer review and continuing education as related to competence and quality assurance;
5. continuing education and self assessment.

The subgroups related to the panel on research in dental disease prevention focused on geriatrics and the suggestions supplied in Horowitz's paper.

The second day of the conference began with a more materialistic nature, since no research can progress without three essential inputs — money, money and money.

We were priviledged to have Dr. Colin Dawes speak on the topic of research grants. In a detailed scenario, Dr. Dawes described how a dental hygienist could become a recognized researcher. He indicated the limits inherent to the holders of a master's degree when they compete for grants against better trained scientists. He stressed the necessity of selecting the right agency, where to present an application, and the need to meet the explicit and implicit grant application requirements. He advocated that the novice researcher start with a pilot project and rely on university funds. Dr. Dawes' detailed advice on preparing a research proposal should afford applicants a fair chance to compete for funding.

The policies and priorities of the agency that support health research in Canada, DNHW, was represented by Dr. Ron Heacock the Director General of the Extra Mural Research Programs. His presentation on the National Health Research and Development Program provided current information on the DNHW and NHRDP research programs.

The papers by Dr. Dawes and Dr. Heacock are contributions of a lasting character that could be used as reference documents by any dental hygienist interested in research.

The panel on Health Promotion, Behavioral Sciences and Implications of An Aging Population was lead by Dr. Dexter Harvey, who reviewed the fundamental concepts of health promotion and suggested ways to apply them to dental hygiene research. He indicated how health promotion is developing its activities through social marketing, mass media, legislation, and community organization, and differentiated between the actual orientations of research on health promotion, namely fundamental research and evaluation research. Dr. Harvey indicated how this methodology can be utilized in dental health promotion programs for:

1. testing the effectiveness of some techniques applied to dental health promotion programs;
2. selecting the most opportune times to maximize the effects of dental health promotion program inputs;
3. applying the principles of motivational psychology in dental health; and
4. measuring the effects of attitudes, values and beliefs on dental health promotion programs.

Next, Dr. Lois Cohen reminded us that research in behavioral and social science has become an important component of dental research in the last decade. The aim of social science research is to identify the social and behavioral factors associated with the etiology, prevention and treatment of oral diseases and with oral health maintenance. These factors are directly influencing public policies and decision making and are at the source of many unmet needs for oral health care. Dr. Cohen pointed out that the crucial issues for dental policy research are who does what and where in dental care delivery. She underscored the void between private dental services and the need for "out-reach" dental services. Dr. Cohen encouraged alliances between dental hygienists and behavioral and social scientists and emphasized the benefits which can emerge from the combination of their respective experience and expertise.

The topic of geriatrics was explored by Sheryl Feller who stated that the rapid growth of the aging population is not what should distress dental professionals most, but rather our state of unpreparedness in meeting the needs of the aged. According to Ms. Feller, the most important issues of the elderly are health and adequate income. Ms. Feller focused on these deficiences when she said: "Dental health professionals need to look closely at age related dental diseases and at the dental health needs and wants of seniors." This area of oral health in the elderly provides an opportunity for dental hygienists interested in identifying researchable problems. After the panel presentations, a small group of conference participants elected to focus exclusively on this topic, demonstrating their commitment to the dental health problems of the elderly.

In contrast, in a recent study, 80 entering dental students, were asked to indicate the type of patients they would consider treating. Some of the choices included children, adults, the elderly, and handicapped persons. Only one student selected the elderly. Although this observation is strictly anecdotal, it is indicative of a state of mind. We seem to have discovered lately that getting old means a myriad of problems including dental care.

The last panel devoted their attention to economic aspects of oral health care. Less than a decade ago, dental planners, busy working for the expansion of dental services, relied heavily on the growth of dental manpower; however, with the economic recession, there appears to be either too many dentists or not enough patients. Although the panelists did not address this problem directly, they discussed factors influencing the quantitative aspects of dental services and topics in need of research.

Within the parameters of the economics of oral health care, researchable problems identified by Dr. Don Lewis included:

1. the issue of supervision and its consequence on the quality and cost of dental services;
2. the national standards and their effects on portability;
3. the matter of tasks and duties, delegation of duties and utilization of auxiliary personnel;
4. the measurement of dental auxiliary productivity and patient satisfaction;
5. the supply of dental services and the distribution of dental personnel.

Dr. John Horne concentrated on three recent developments affecting dental manpower:

1. the rapid growth of third party dental insurance;
2. the rapid growth in the capacity of the system due to increased dental manpower;
3. the proliferation of dental hygiene programs in community colleges.

Dr. Horne's list of researchable problems illustrates what can be done in dental economics research.

The last panelist, Dr. David Fish, first addressed the reasons why dental hygienists should be participating in research activities, assum-

ing that practising professionals have a definite role in determining the barriers to and the facilitators of their services. Their participation in research is even more legitimate when considering that such a small proportion of the population receives optimal dental care. Dr. Fish then discussed research opportunities indicating that work needs to be initiated to establish the standards of care upon which evaluation is based and on factors influencing the patient compliance in relation to preventive and therapeutic dental services. Dr. Fish encouraged dental hygienists to seek training in epidemiology, sociology and other substantive disciplines which are most relevant to the research problems mentioned.

The issues raised and discussed at this Conference focused on what is dental hygiene research and who will do it. Research teams are the result of horizontal integration of goodwill and intellectual ability, originating from a concept entirely different from the concept of vertical team work developed in the dental office. For health services this vertical team concept was a useful model; however, with the growing complexity of the health care system, there is a need for more horizontal coordination. Attention must be focused on mechanisms to render the health care system more flexible and effective. Interdisciplinary team efforts should be instrumental in improving health care delivery. Dental hygienists, given their role in health care, are ready to make important and unique contributions as members of the interdisciplinary team.

One important issue is the matter of public policy research and the political influences constantly infiltrating the process of decision making. Public policy research must be considered with more agressiveness, realizing that data collected are of little value if not applied to the very situation where they can produce a change. Researchers in the health fields are accountable to the media and the public for the support they receive. Consequently, the public is becoming more sensitive to their messages and more likely to participate in public policy decisions.

The information discussed at the conference was comprehensive. Relying on this information, each of participants must decide upon the research directions to take and the type of role to play, such as principal investigator, research assistant, field coordinator, clinical investigator, etc. If dental hygiene intends to compete in the research arena, it will have to recognize the need for adequate training. Today, more emphasis is placed on PhD training to prepare future researchers. Such training is certainly an investment toward the achievement of research goals.

Although the decisions to participate in research activities belong to the individual, dental hygienists will require assistance from the institutions with which they are associated. The Canadian Dental Hygienists' Association will need to provide its members guidance and support services similar to what the American Dental Hygienists' Association is establishing with its research initiative project.

This summary is far from being fair to the faculty and the participants. In spite of it, participants will leave with the deep and lasting impression that this conference was a most profitable experience and the first step toward the establishment of a research commitment for the Canadian dental hygiene profession.

CONFERENCE LEADERS

DENISE BOWEN received her MSc and BSc degrees from Old Dominion University, Norfolk, Va., and certification in expanded functions from the University of Washington. She is co-author of the book *Research Methods for Oral Health Professionals*, has written several research articles in periodontology and preventive dental care, and is associate editor for research for *Dental Hygiene*. She holds a joint teaching appointment at Idaho State University and Creighton University School of Dentistry, and is past chairman of the University Faculty Senate, Idaho State University.

LOIS COHEN is a sociologist who received her training at the University of Pennsylvania and Purdue University. For the past eighteen years she has worked in dental research with the United States federal government. Her positions have included Chief of Social Research in Dentistry and Planning Officer for the National Institute of Dental Research. She is, perhaps, best known for editing two books, *Social Sciences and Dentistry* (Federation Dentaire Internationale) and *Towards a Sociology of Dentistry* (Milbank Memorial Fund Quarterly), and is co-director of U.S./W.H.O. International Collaborative Study of Dental Manpower Systems in Relation to Oral Health Status, a major research effort now operative in eleven countries.

MICHELE LEONARDI DARBY is Chairman and Associate Professor of Dental Hygiene and Dental Assisting at Old Dominion University, Norfolk, Virginia. Ms. Darby has served as Chairman of the American Dental Hygienists' Association, Council on Educational Services and Research. In 1980, her book, *Research Methods for Oral Health Professionals* was published by the C.V. Mosby Company. In addition to numerous publications, Ms. Darby has served as Editor of *Educational Directions*, Journal of the American Dental Hygienists' Association Foundation and as Editor of *Dental Hygiene*, Journal of the American Dental Hygienists' Association.

COLIN DAWES has degrees in physiology and dentistry from the University of Manchester and a PhD in oral physiology from the University of Durham. After two years of post-doctoral study at the Harvard School of Dental Medicine he joined the Faculty of Dentistry at the University of Manitoba where he is now Professor of Oral Biology and Director of Graduate Studies and Research.

SHERYL FELLER is a graduate of the School of Dental Hygiene, University of Manitoba, and also holds a BA and MBA. She has served as Assistant Professor at the Faculty of Dentistry and the School of Dental Hygiene at the University of Manitoba, Acting Director of the School of Dental Hygiene, lecturer at the Faculty of Administrative Studies and as an instructor in the Management Development Program, Red River Community College. Sheryl currently holds the position of President for SJB Management Consultants. She is also Vice-President of Western Opinion Research, a Winnipeg-based research firm.

DAVID FISH is Head of the Department of Social and Preventive Medicine, Faculty of Medicine, University of Manitoba. A sociologist by training, his interest in dental research began with the development of a longitudinal study of the process of dental education, following entering dental students through to their entry into practice. He has subsequently been involved as a consultant in the design of a baseline study of the dental health of children in Manitoba prior to the introduction of the government-sponsored children's dental health plan. Dr. Fish was a major contributor in the design and execution of a study to measure the impact of the provincial plan on the dental health of children.

DEXTER HARVEY is the professor in charge of the health promotion/education graduate program at the Faculty of Education, University of Manitoba. Dr. Harvey is active in health education program planning and evaluation in both the school and community settings and serves as an advisor to several provincial and national health organizations. Dr. Harvey's research interests pertain to evaluation research and community-based programs.

RON HEACOCK received the degrees BSc, PhD, and DSc from Kings College, London. His more than 100 publications reveal a wide variety of research interests, including explosives, agriculture, mental illness, and drug abuse. He has held teaching positions in London, Saskatchewan, and at Dalhousie University, and since 1974 has been Director General of Health and Welfare Canada's National Health Research and Development Program. He is a member of the WHO Fellowship selection committee; an associate member, MRC; and a Fellow of the Chemical Institute of Canada and the Royal Society of Chemistry.

JOHN HORNE is Associate Professor and National Health Research Scholar in the Department of Social and Preventive Medicine, University of Manitoba. During 1981-82 he was Visiting Associate Professor and Visiting National Health Scientist at the School of Public Health and Community Medicine, University of Washington. He has published articles on hospital costs and utilization, medical manpower and technology, and the effects of co-payment on access to services under public universal health insurance programs. He has advised various governments on health policy issues, and recently served as a consultant to the Province of Manitoba's Children's Dental Health Review Committee. His current research involves economic evaluation of various diagnostic technologies, and an analysis of the structures, processes, and outcomes of medical fee determination under Medicare.

ALICE HOROWITZ received both her bachelor's degree in dental hygiene and her master's degree in education from the University of Iowa. She was an Assistant Professor in the College of Dentistry, University of Iowa from 1962-66. She joined the United States Department of Health, Education, and Welfare in 1966 and has worked primarily in preventive dentistry as related to the young child. Mrs. Horowtiz has developed numerous health education materials and has initiated preventive dental programs in many communities across the country. Her research and publications have focused on mechanical plaque removal and its relationship to dental disease and the use of self-applied fluorides in school settings. She is currently Coordinator of Health Education and Promotion Activities at the National Caries Program, National Institute of Dental Research, National Institutes of Health, United States Department of Health and Human Services, Bethesda, Maryland.

DON LEWIS is professor of Community Dentistry, Faculty of Dentistry, University of Toronto, formerly chairman of the Department (1967-81). He is Co-founder and Director of the Dental Health Care Services and Epidemiology Research Unit at the same institution. His main current research interests include: various aspects of dental manpower and evaluative research; levels of scientific evidence for various dental preventive and therapeutic treatments; dental clinical trial analysis; and the diffusion of dental technology. He has acted as a dental consultant to governments provincially, nationally and internationally, and to various voluntary dental associations.

JEAN-PAUL LUSSIER is a graduate of dentistry at the Université de Montréal in 1942. Jean-Paul Lussier spent four years in practice before he turned to dental education. He taught pharmacology, physiology, nutrition and preventive dentistry. His research interests include endocrinology and especially bone metabolism. Appointed Dean of the Université de Montréal Faculty of Dental Medicine in 1962, he held this function until 1979. He is now Chairman of the Health Sciences Coordinating Commission at the Université de Montréal.*

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DENISE O'BRIEN received a BS in Dental Hygiene and MSc in Adult Education from the University of Michigan. She has practised dental hygiene in Switzerland and the United States, has been an assistant professor in a dental hygiene program, and was recently Manager of Educational Development and Research for the American Dental Hygienists' Association. She is currently a full-time PhD student in applied sociology at the University of Loyola, Chicago, where she has been awarded a scholarship and university assistantship.

JOHN STAMM is Professor and Chairman, Department of Community Dentistry, McGill University. He obtained his dental degree from the University of Alberta, a diploma in dental public health from the University of Toronto and a master's degree from the same institution. He is a Fellow of the Royal College of Dentists(C) and a Diplomate of the American Board of Dental Public Health. At the present time he is Chairman of the National Health Research and Development Program's Advisory Committee as well as a consultant to a number of other scientific and professional bodies. His current research interests include the design and analysis of health surveys and clinical trials, the financing of dental care and the development of dental health care policy.

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